

**CONSTRUCTION OF A NEW COMPLEX TO HOUSE
THE GUYANA NATIONAL BUREAU OF
STANDARDS**

**NAME OF DEVELOPER: NATIONAL QUALITY
INFRASTRUCTURE PROJECT, MINISTRY OF
TOURISM, INDUSTRY, AND COMMERCE**

SEPTEMBER 2022

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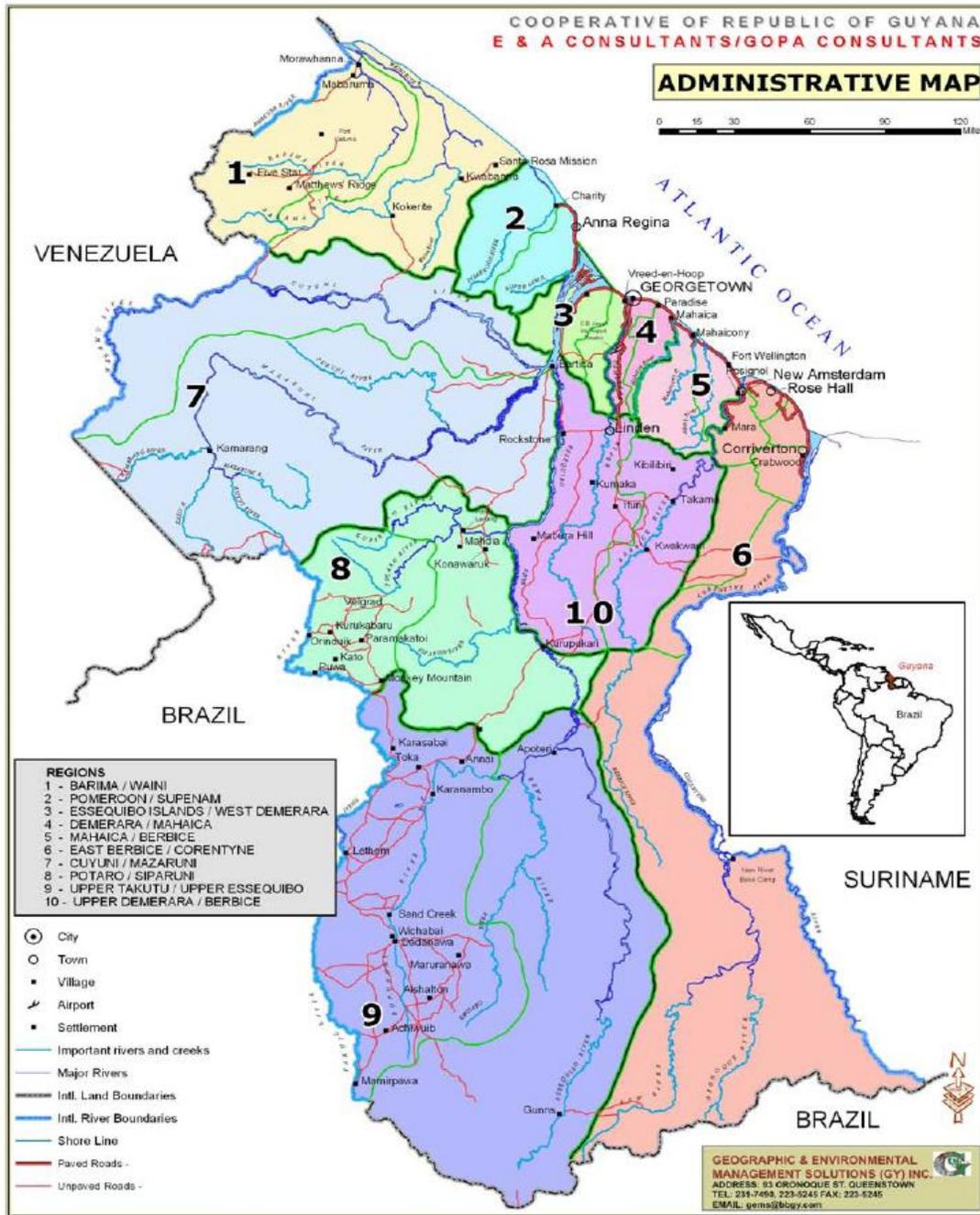
DESCRIPTION OF SITE

The MoB is working to construct a new laboratory facility for the GNBS. This facility will be situated in Sophia Exhibition Complex (SEC), Greater Georgetown in Administrative Region Four, i.e., Demerara-Mahaica ([see Map 1](#)). The new building is expected to be situated on a 2.156 acres plot of vacant ([see Picture 1](#)) state-owned land in a commercial zone that has mainly office buildings or land earmarked for commercial development ([see Map 2](#)). The new facility is expected to have three (3) one flat structure and one two-flat structure to house the Administration Block. Additionally, chemicals (such as sulphuric, nitric and hydrochloric acids) will be stored in the Industrial Metrology Building and various fuels (such as diesel and gasoline) will be stored for short durations in a section to be designated in the Legal Metrology Building. The exact location in which these substances are to be stored is still to be identified as at the time of writing this report the floor plan for the new facility was not available. However, we do posit some recommendations to treat with any potential impacts that may emerge from storing these substances in the various buildings.



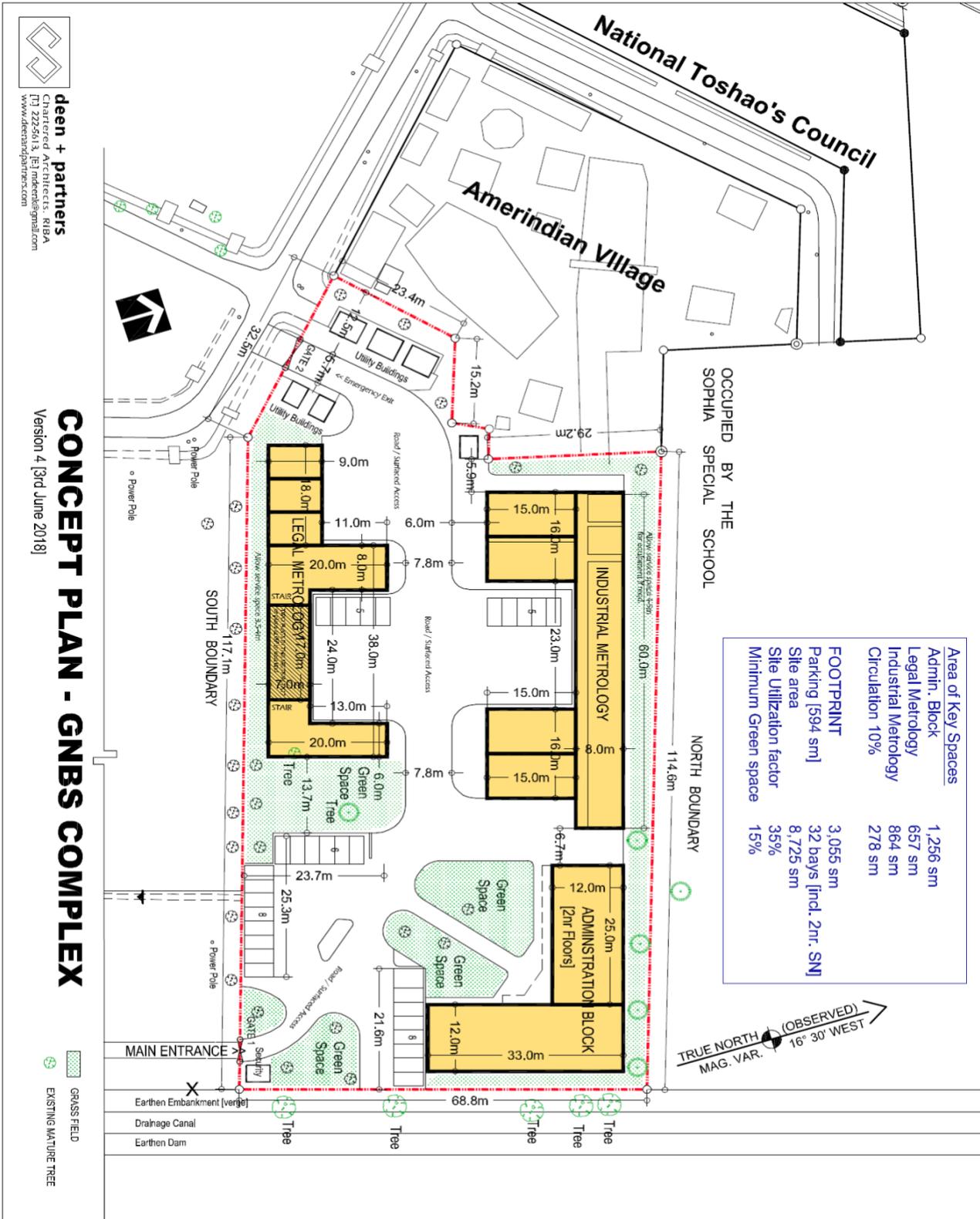
Picture 1: Proposed construct site located within the Sophia Exhibition Complex

Map 1: Administrative Regions of Guyana



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

Map 2: Location of the Project Site (bordered in red) within Sophia Complex



Source: Deen & Partners (2018)

The facility to be built is bordered on the north by the Sophia Juvenile Holding Centre, Sophia Training Centre (see Pictures 2 & 3), the Sophia Special School (SSS) for children with learning challenges, and the Sophia Care Centre for homeless children; on the East by a secondary drain, the A-Field Sophia Dam (see Picture 4), and the primary drainage facility in the Downer Canal; on the South by State-owned lands that are currently unoccupied, and on the West by the Eastern Highway is being proposed as the main access to the SEC (see Picture 5). This road is in very good condition and is a public thoroughfare. These borders form the area of direct influence (ADI) within this project as demonstrated in Map 3 below. Within the ADI are, *inter alia*, the current GNBS complex, land designated for the National Tosaos Council Headquarters¹, the Competition Commission Secretariat, and SEC Administration Building, the NQI Project Office and an “Amerindian Village” which is a facility used to showcase the work and life of the indigenous Guyanese peoples largely during the Exhibition Season.



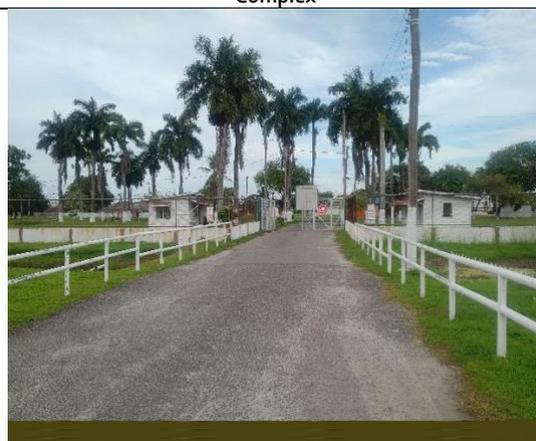
Picture 2: Sections of the Sophia Training Centre located in the compound located immediately north of the Sophia Exhibition Complex



Picture 3: Sophia Juvenile Holding Centre located in the compound immediately north of the Sophia Exhibition Complex



Picture 4: Image of earthen dam located east of the eastern fence separated from the compound by a trench which is overgrown with brush and weeds



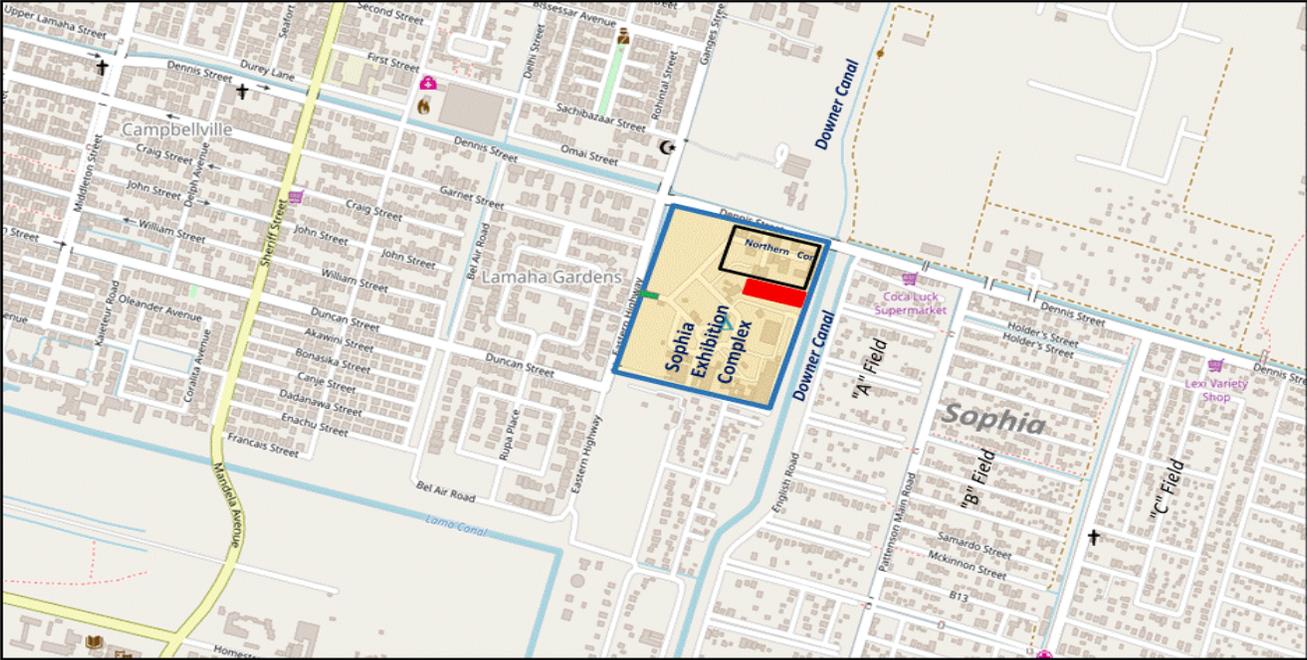
Picture 5: Eastern Highway entrance to the Sophia Exhibition complex

Source: Consultant’s Pictures (2018)

¹ This is a HQ for the indigenous peoples’ chiefs/captains known in their traditional language as Tosaos.

Outside the ADI are a number of communities that fall within the area of indirect influence (AIDI). For example, immediately west and northwest of the Eastern Demerara highway are two middle income housing communities, namely, Lamaha Gardens and Prashad Nagar (*Map 2 and Picture 6*). At the same time, East of the proposed site is the Sophia community, one of the largest housing communities in Guyana that started as a squatter settlement, but which has since been regularised (*see Picture 7*). These communities are only expected to be tangentially impacted, mainly due to increased traffic that may be associated with construction and operation activities of the proposed project.

Map 3: Location of the Project Site



Key	
	<i>Proposed Construction Site</i>
	<i>Zone of Direct Influence</i>
	<i>Main Access Point to Complex</i>



Picture 6: The Lamaha Gardens Community on the Western Section of the Proposed Site



Picture 7: The Sophia Community on the Eastern and North Eastern Section of the Proposed Site.

Source: Consultant's Photographs (2018)

Project Design

The new state of the art laboratory facilities is expected to utilise an area of 3,172 square meters of state-owned land. The compound is expected to comprise the following buildings: **Main Building:** Ground Floor - 28,082 s.f.; First Floor - 8,325 s.f.; Mezz. Floor - 579 s.f.

Truck Building: 3,336 s.f.

Services Building: 3,028 s.f.

The total site area to be occupied by building would be 34,446 Square Feet.

The preliminary blueprints of the laboratory facility are expected to be derived from the Gaps and Needs Assessment carried out in 2014. One possibility is also for the structures to be green, pursuing renewable energy potentials and energy efficiency ethos as far as practicable. This will also complement Guyana's Low Carbon Development Strategy.

- the construction of a two-storey main building of 37.340 square feet gross floor area to accommodate laboratories, administration, and ancillary support areas
- the construction of a single storey services building to accommodate security, services and maintenance areas
- the construction of a two-storey truck bay testing area
- external works comprising of site preparation, surface water drains, landscaping, roads and carparks, fencing and gates, sewage collection and disposal, water mains and reticulation
- electrical mains and supply to the buildings on site

The implementing agency for this project are Ministry of Tourism along with the Inter-American Development Bank (IDB). The client is Guyana National Bureau of Standard (GNCS). The consultant is Vikab Guyana Ltd and the general contractor undertaking the construction is Nabi Construction Inc.

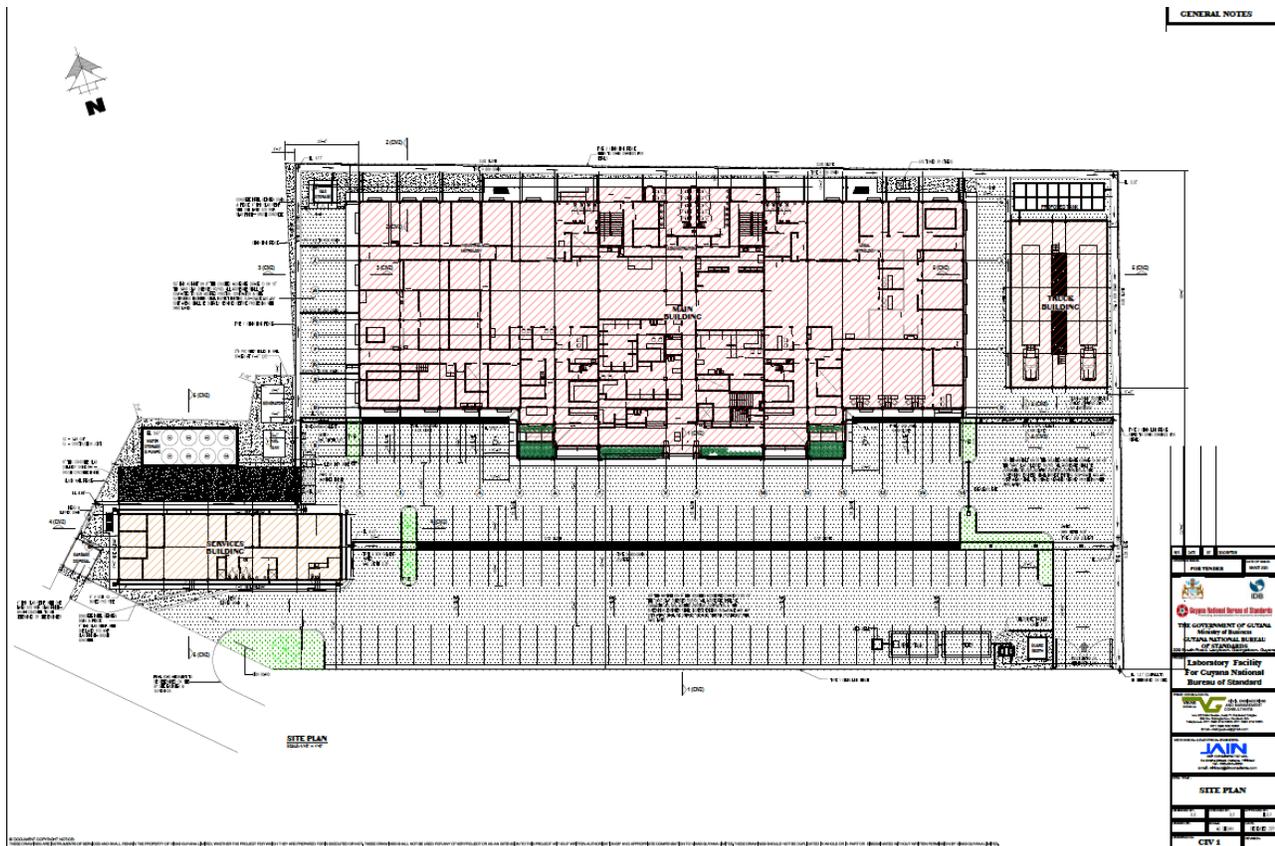


Figure: Design of Buildings (Vikab 2020)

Access and Drainage

Access to the proposed project site can be via many sources, inclusive of the East Demerara Highway, Dennis Street, Duncan Street, Garnett Street, and A-Field Sophia. However, the last of these options would require significant investment in building at least two bridges, building an access road from Dennis Street, and possibly having to relocate some squatters (*Pictures 8 & 9*). All of these are likely to increase the cost of the project and delay its implementation. As such, the most feasible options would seem to be to use the current entry points into the site or rehabilitate those that have become defunct. These are in the main, via the East Demerara Highway, using the entrance to the far south of the SEC using the Duncan Street entrance (*see Picture 10*), the main entrance (*see Picture 11*), the entrance closest to Garnett Street (*see Picture 12*) that is in some semblance of disrepair, or using the Dennis Street entrance (*see Picture 13*).



Picture 8: Access via A Field Sophia which will be very costly



Picture 9: Squatter Settlement on the earthen dam East of the SEC

Source: Consultant's Photographs (2018)



Picture 10: Duncan Street Entrance



Picture 11: The main entrance from the East Demerara Highway



Picture 12: Garnett Street Entrance

Picture 13: Dennis Street Entrance

Source: Consultant's Pictures (2018)

However, to enter the plot from any of these access points will require some upgrading in the internal roads to facilitate the movement of construction materials, and to facilitate operational activities. Any of the entry points selected should be accessed via the construction of an all-weather road as it will aid with both mitigating dust pollution and make the site more accessible during the rainy season. The GNBS has indicated a preference for the upgrading of the road to the far south of the SEC. In 2019 the road to the far South of the SEC via the Eastern highway was upgraded by a contractor hired by the project. The Final Design and improvements were done using counterpart resources. The road was treated as an Associated Facility and built in keeping with the ESPS of the bank and the environmental requirements of the Guyana Environmental Protection Agency (EPA). The road through its design minimizes the potential for runoff and sedimentation. It also considered the disruptions and limitations to access of other users of the buildings of the complex. The chosen road and improvements will not adversely affect the squatters.

Much of the surface water in Guyana runs from the highlands in the south to the lowlands in the north and then into the Atlantic Ocean via various rivers, streams and outfalls using gravity. With regards to drainage at the proposed site, the SEC is bordered on both the east and the west by access drains. While the drain to the west is in fairly good condition and well maintained, the one to the east is over-grown by brush and in need of dredging (*see Picture 14*). These drains empty into the main access drain that runs parallel and south of Dennis Street and then empties into the Downer Canal that empties into the Atlantic Ocean via the Liliendaal Pumps (*see Picture 15*).



Picture 14: The drain to the east of the SEC overgrown by brush



Picture 15: The Liliendaal Pump Station through which the Downer Canal empties its contents

Source: Consultant's Pictures (2018)

The entire SEC is serviced by internal drains that appear to be well maintained (*see Picture 16*), if somewhat shallow, particularly when it is recognized that the site may become susceptible to flooding in the face of climatological changes. Furthermore, as more impermeable structures are erected at the SEC, there will be a greater run-off, thus testing the carrying capacity of these internal drains. Given that the project site is on a flood plain it is imperative that going forward, some thought be given to ensuring all buildings are

constructed within the building code of Georgetown, i.e., at least 4 feet above ground level, and the drains be deepened to cater for the greater overland flow. This drainage issue needs to be treated with the utmost urgency to mitigate possible flooding and water contamination from any chemicals stored in the Industrial Metrology building.



Picture 16: Internal Drains at the Project Site

Source: Consultant's Photographs (2018)

Waste Disposal

It is the expectation that with regards to solid waste the facility will have bins where waste separation and collection will occur. The area is serviced by private contractors using compactors under private arrangements. Currently, the private contractor that services the proposed project site collects waste from the GNBS under a private contract at a cost of G\$4,000 (US\$19.50) per month. This contract is expected to remain in place when the new facility is built. The collection of waste is driven by demand, with the private collector collecting waste twice weekly at the moment. The frequency will also impact the price for collecting waste. The GNBS generates on average approximately three (3) 170-kilogram barrels of waste per week. This waste is disposed of at the Haag Bosch Landfill Site at Eccles on the East Bank of Demerara which is approximately 5.5 kilometres from the proposed project site.

Given that this area falls within the one classified as Greater Georgetown, there is no central sewerage system. Each business or office building is expected to install its own sewerage facility during construction. These septic tanks tend to be located in the ground, built out of concrete material and are built with the possibility of flooding in mind. Once filled, private contractors are contracted to drain and clean these tanks. It would be important that effluent from this system does not get into the nearby drains, resulting in foul odour or pollution of the freshwater system, particularly, given the proximity of the proposed facility to residential communities.

The new facility will focus heavily on testing, metrology and certification. In its testing, it will continue to utilise sulphuric, nitric, and acetic acids. The facility will continue to test textiles, gold and concrete blocks. However, currently, the primary environmental issue that affects the operations of the GNBS is its inability to effectively dispose of chemical/hazardous waste. It was explained that currently they are no existing standards for the storage of hazardous chemicals and disposal after use. This situation has resulted in chemical waste being stockpiled at the facility. Dilution has also been utilized for the disposal of nitric acid. The diluted solution is poured in drains at the current GNBS facility. However, the Bureau reported that the amount of chemical waste stored is not of a large volume. Proposed mitigating measures to arrest this practice are outlined in the ESMP and will need to be implemented given the increase in volume of activities the facility will be expected to process, with the projected increase in economic activities associated with the emerging oil and gas sector. This last point becomes even more critical should Guyana decide to refine some of its petroleum within the country.

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

Utilities

The area of the proposed project is well served with the basic infrastructure, inclusive of water, telecommunication and electricity. The facility will access metered water from the Guyana Water Incorporated (GWI). The proposed site is serviced by the East Demerara Water Conservancy (EDWC) at the Shelterbelt location on Vlissengen Road. This Shelterbelt distribution system was established in the 1920s

and is currently undergoing major rehabilitative works. Water from the Shelterbelt Plant is available to the site on a 24-hour basis, but the Plant does suffer on occasions from periodic maintenance, causing disruption to its service, or from power outages that also negatively impacts the quality of the service provided. Both the water pressure and quality are said to be good. The cost per water in Guyana is G\$180/m³ (approximately US\$0.88/m³)².

However, with the Global Climate Models (GCMs) downscaled to adequate regional resolution predicting longer and drier summers and less annual rainfall³, it would be prudent for the facility to also consider putting in place rainwater harvesting facilities, and some greywater recycling to reduce water wastage and increase efficiency. This will also be a resilience building measure to ensure that the new facility's operations are not interrupted by (un)scheduled maintenance or power outages at the Shelterbelt Plant. The actual dimensions of the system would be based on projected demand and will have to be worked out with the contractor.

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

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

NON-TECHNICAL SUMMARY OF PROJECT

The works consist of:

- the construction of a two-storey main building of 37,340 square feet gross floor area to accommodate laboratories, administration, and ancillary support areas
- the construction of a single storey services building to accommodate security, services and maintenance areas
- the construction of a two-storey truck bay testing area
- external works comprising of site preparation, surface water drains, landscaping, roads and car parks, fencing and gates, sewage collection and disposal, water mains and reticulation
- electrical mains and supply to the buildings on site

² This is using an exchange rate of US\$1 = G\$205.

³ Caribbean Community Climate Change Centre (2012) Achieving Development Resilient to Climate Change – Implementation Plan 2011 – 2021, CCCCC, Belmopan.

The implementing agency for this project are Ministry of Tourism along with the Inter-American Development Bank (IDB). The client is Guyana National Bureau of Standard (GNCS). The consultant is Vlkab Guyana Ltd and the general contractor undertaking the construction is Nabi Construction Inc.

Duration of the Project

The project is expected to last 18 months.

Potential Effects on the Environment

IMPACTS

Social and Community Impacts

The impacts during the mobilization phase would be mainly social and confined mainly to the users of the facility. The impacts will include the following:

Reduce Access to the Area where the building will be placed because of the stock piling of building materials and other activities. In addition to reduction in the activities, the planned activities of the users will be disrupted. Among the major activities that will be affected are Indigenous Month Celebrations in the month of September and Guyana Exhibition that will be held in December 2022. These community impacts will be addressed through the stakeholder engagement plan.

A. Construction Phase

IMPACTS

Air Quality

A major source of atmospheric disturbance will be from airborne particulates from soil disturbance during construction of the buildings and from vehicular traffic transporting materials along the roads (*see Table 12*). The building is expected to be concrete, using sand, stones and cement. The stones and sand are likely to come from the BK or Toolsie Persaud Quarries in Region 7, and the Linden-Soesdyke Highway respectively. These are likely to be main sources of dust pollution falling within the AII. These impacts will have a high probability of occurrence and a low level of severity after mitigation.

Noise

Another potential source of atmospheric disturbance will be noise generated largely during the construction of the facility. This is likely to be associated with sawing of wood, mixing of mortar and nailing of materials. However, since this is already in a zone with frequent traffic, the impact on surrounding stakeholders, especially if work is done during the day time, is projected to be minimal. Furthermore, the fact that the construction is expected to take place on the leeward side of the Sophia facilities, the impacts are expected to be less than if the converse was true. Nevertheless, due consideration should be given to reducing the noise, such as piling outside of working and school hours, or at nights. Similarly, minimal use of vehicle horns should be encouraged at all times at the construction site and only in the case of emergencies. Where night work is to be carried out, residents in the Lamaha Gardens and Prashad Nagar areas should be notified at least 48 hrs before such works commence. These impacts will have a high probability of occurrence and a low level of severity after mitigation.

Soils

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

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

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

Biological Resources

The construction operations, operation of power generation equipment and roadway traffic will generate noise levels higher than currently existing background levels. Increased noise levels can potentially impact animals and modify their behaviour as it relates to search for food and nutrient supplies. It may also potentially impact the location of breeding areas and migration routes, and vulnerability to predators. But

given the denuded environment of the potential project site these are direct, short term and reversible impacts. These impacts are of low severity and have a low likelihood of being realized in the project site at a particular point in time. Noise impacts can be mitigated by carrying out activities mainly during the day time hours, which is what the expectation level is with regards to this project.

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

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

Ground and Surface Water

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

Social Impacts

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

Waste: Burial of wastes or leachates, generated by both equipment and human presence during the construction phase, can potentially impact groundwater quality. Inert, non-recyclable materials, waste

water from the laboratories and cleaning of the vehicles, and waste oils will be collected, but small residues may spill onto the ground. Leaching from these spills can potentially impact groundwater quality. These are local, medium term and reversible impacts. These are moderate impacts with a medium severity level and a moderate likelihood of occurrence. These impacts will be mitigated by constructing holding and collection areas, with specialised septic tanks with filter beds. The waste can then be treated and released into the atmosphere once deemed safe by the EPA. The mitigation measure will result in minor residual impacts of low severity and with a low likelihood of being realized.

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

Labour and Working Conditions: The project will hire both direct and indirect workers as a result there will be several risks associated with working conditions. The associated risks are expected to be direct, short term and manageable.

B. Operational Phase

Atmospheric Impacts

Air Quality

During the operation of the complex a major source of atmospheric pollution would arise from the combustion of diesel and other fuels from mechanically driven vehicles and the operation of the stand-by generator during periods of power outage. Principal emission compounds will include carbon dioxide (CO₂), carbon monoxide (CO), carbons and nitrogen oxides. Emissions of sulfur dioxides (SO₂) and hydrogen sulfide (H₂S) would be dependent on the sulfur content of the hydrocarbon and diesel fuel used. The impacts of these pollutants are likely to be felt most severely by persons suffering with respiratory ailments and small children. Application of the mitigation measures will aid with managing the impacts associated with atmospheric emissions. These impacts will have a high probability of occurrence and a low level of severity after mitigation.

Greenhouse Gas (GHG) Emissions

Guyana has a signatory to the Paris Agreement is concerned about its project activities contributions to its national emissions. The country has committed itself to a Low Carbon Development Strategy (LCDS). The IDB ESPS₃ Resource Efficiency and Pollution Prevention will also be triggered because of the GHG emissions of the building during the constructional and operational phase. The initial calculations for the GHG of the building are as follows;

Initial Review		MT CO2e
Land Use Change		5
Road Pavement- Construction		51
Road Pavement- Annual Maintenance		2
Building Construction		1,274
Neighborhood Operation: Emissions from Purchased Electricity		98
Indirect Emissions from Road Operation: Increase in Vehicle Miles Traveled		0
Subtotal		1,430

Total Emissions (Resulting from Initial Review)

Construction: **1,329** MT CO2e Operational: **100** MT CO2e

 Avoided Emissions from Energy Efficiency Upgrades: **0** MT CO2e

Soils

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

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

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

Biodiversity

A critical concern is the disposal of waste and how this would affect the aquatic life in and around the project area. During use, new oils pick up toxic chemicals, carcinogenic hydrocarbons, and heavy metals which harm the environment and public health when used oil is disposed of improperly. One pint of oil can produce a slick covering approximately one acre of water. Used oil in waterways threatens fish, waterfowl, insects and aquatic life. These impacts would be medium term and reversible and would be localized to the ADI. These are moderate impacts with a moderate severity level and a moderate likelihood of occurrence. With the indication that some residual oils escape during testing of fuel tankers, it will be important to take measures to reduce this practice by having a holding and testing bay at the new facility with the requisite collectors.

Water Quality

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

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

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

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

Socio-Economic

Economic Activities: The GNBS complex may potentially induce further land use changes which may lead to economic advancement of surrounding communities. These are positive, direct, long-term, irreversible

impacts. These are moderate impacts with a medium level of enhancement and a medium likelihood of occurrence.

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

Job creation: During the consultations with the GNBS it was revealed that the facility, once completed, will be hiring approximately 120 persons, which represents an addition of 64 persons above what the Bureau currently employs or a more than 100% increase. Most of these persons will be in specialist areas and are expected to enhance the confidence persons and businesses will have conducting transactions with the entity. This will also aid with providing increased disposal income, quite likely in many cases, to the persons being employed. This can lead to an improvement in their standard of living. These impacts are expected to be short to medium term, localised, significant with a high likelihood of occurring.

Increase in traffic along secondary roads: If the project decides to utilise secondary routes to access the site, such as via Dennis Street, or the site via the Duncan Street entrance may result in reduced life of such roads as well as exposing other users of these thoroughfares to the possibility of more accidents. Additionally, since other users, i.e., the NGMC packaging plant utilises the Duncan Street entrance, the constant movement of vehicles transporting construction material may impact the other operations in the SEC. This will need to be carefully monitored with a constant traffic warden at the entrance (should this be the preferred access route) to direct traffic accordingly. These are short term direct and reversible impacts that have a high probability of occurring. Careful planning before the project is executed and continued public consultation can help alleviate some of the negative impacts.

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

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

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

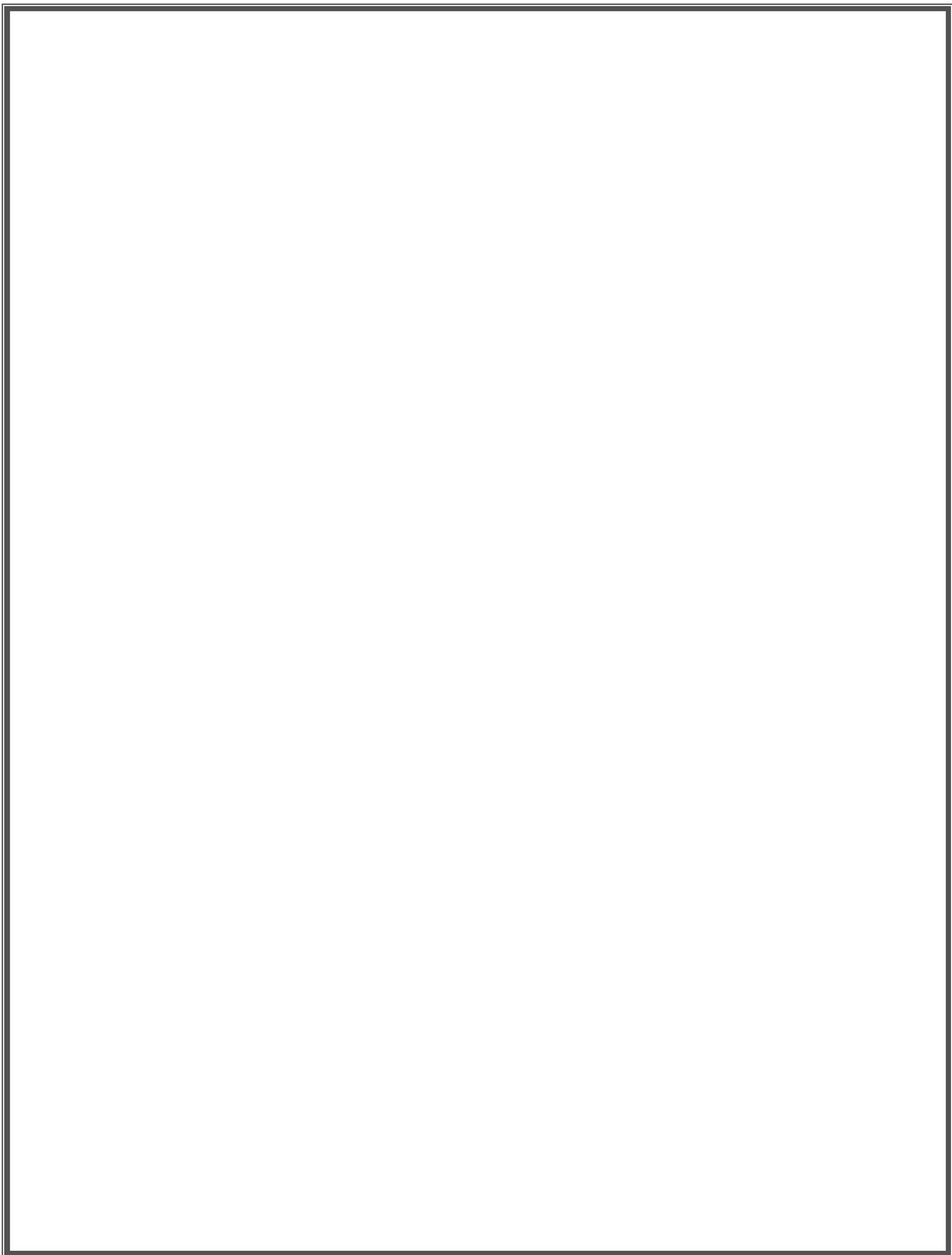


Table 2: Magnitude of the Various Positive and Negative Impacts Projected during the Construction and Operational Phases of the Proposed Project

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

Medium	Phase	Sensitive Receptors	Type of Impact (Direct/ Indirect)	Significance before mitigation/enhancement						
				D	I	O	E	Du	R	Total
Socio-Economic	1. Congestion of the roadway, particularly at peak hours	School children and the elderly	D	1	1	2	1	1	1	-7
	2. Increased traffic through secondary streets	Children	I	3	3	3	2	1	1	-13
	3. Damage/disturbance to streets and possible increased accidents	Residents and road-users	I	2	2	2	2	1	1	-10
	4. Vandalism of construction tools and materials	Contractors	D	3	3	2	2	3	2	-15
	5. Increases in construction accidents	Persons not directly involved in the construction activities	I	2	2	1	2	2	2	-11
Positive Impacts										
Socio-Economic	1. Short term job creation for residents in neighboring communities		D	2	3	3	2	1	1	12
	2. Increased demand for supply for raw materials from local quarries and mining sector		D	2	1	3	2	1	2	11
	3. Increase in skills of workers from community		I	3	3	3	2	2	2	15
	4. Improved family life and cohesion		D	3	3	3	3	2	2	16
Operational Phase										
Negative Impacts										
Atmospheric	1. Decline in air quality	Children, the elderly and the physically challenged	D	3	2	3	3	2	1	-14
	2. Increased congestion on Lamaha Street	-	I	3	2	2	2	3	1	-13
	3. Ground water pollution	Residents in the All and Stakeholders in the ADI	D	3	3	2	2	2	1	-13
Geology and Soil	1. Increased pollution due to improper waste disposal	Residents in the All and Stakeholders in the ADI	D	1	3	3	2	2	2	-13
	2. Reduced productive capacity of soils	Stakeholders in the ADI	I	1	1	2	1	1	1	-7

Medium	Phase	Sensitive Receptors	Type of Impact (Direct/ Indirect)	Significance before mitigation/enhancement							
				D	I	O	E	Du	R	Total	
Biodiversity	1. Impact on aquatic life	Residents in the All and Stakeholders in the ADI	I	1	2	2	2	1	1	-9	
	1. Increased run-off	Residents in the All and Stakeholders in the ADI	D	2	2	2	2	1	1	-10	
2. Reduction in aquifer recharge rates	D		1	2	1	1	1	1	-7		
3. Change in vegetation	I		1	1	1	1	1	1	-6		
Labour Risks	1. Occupational Health & Safety	Workers	D	2	3	2	2	1	1	-11	
	2. Unfair treatment or discrimination of project workers	Workers	D	2	3	2	2	1	1	-11	
	3. Physical, psychological, or sexual harassment of project workers	Workers	D	2	3	2	2	1	1	-11	
	4. Child and Forced Labour	Children	D	2	3	2	2	1	1	-11	
	5. Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH)	Workers, children and women from communities	D	2	3	2	2	1	1	-11	
Socio-Economic	1. Increased traffic congestion	Residents in the All and Stakeholders in the ADI	D	2	2	2	2	1	1	-10	
	2. Increased vandalism	New GNBS Complex and stakeholders in the ADI	I	1	2	2	2	1	2	-10	
	Positive Impacts										
	1. Improved standards	Populace of Guyana	D	3	3	3	3	2	2	16	
	2. Improvement in income for exporters from Guyana	Populace of Guyana	I	3	2	2	3	2	2	14	
	3. Increased job creation and better training for staff at the GNBS	Communities near the project site	I	3	3	3	3	2	2	16	
	4. Better working conditions at the GNBS	GNBS Staff	D	3	3	3	2	2	2	15	
	5. Increased competitiveness of Guyanese exports	Populace of Guyana	I	3	3	2	3	2	2	15	
6. Improvement in property value	Communities near project site	I	3	2	3	3	1	2	14		

Medium	Phase	Sensitive Receptors	Type of Impact (Direct/ Indirect)	Significance before mitigation/enhancement						
				D	I	O	E	Du	R	Total
	7. Better coordination amongst standards agencies	Populace of Guyana	I	3	3	3	3	2	1	15
	8. Improvement in social amenities	Stakeholders in and around project site	I	3	3	3	2	2	2	15
	9. Improved waste management system	GNBS	D	2	3	3	2	2	2	14
	10. Better output from workers	GNBS	D	2	3	2	2	2	2	13

MITIGATION MEASURES

A. Air Quality Management

- 8.1 The noise emissions could be limited by appropriate soundproofing of individual pieces of equipment. Equipment will be fitted with special exhaust systems (mufflers). Additionally, the employees will be required to wear personal noise-protection gear, e.g., ear protectors.
- 8.2 The implementation of these measures will commence during the construction phase of the Project and the Project Management Unit (PMU) will be responsible for implementation. The costs associated with these measures are part of the project costs.
- 8.3 All vehicles transporting materials will be expected to be covered to reduce air pollution. Furthermore, as part of the contract with the Contractor for the buildings, it should be made a condition that only trucks with covered trays should be hired.

B Protection of Soils

- 8.4 To reduce the impact of excavation and earth movements in the construction phase, mitigation measures are required. The exposed surface should be covered with grass and re-vegetated as soon as possible. Erosion measures are to be implemented during construction. Further, the project will be undertaken with long-term erosion and sediment control as primary considerations. Operations conducted during the rainy season will be carried out to the satisfaction of the EPA by ensuring that at no stage of the operations will there be any substantial risk of increased sediment discharge from the project site.
- 8.5 Natural features, including vegetation, terrain, watercourses and similar resources shall be preserved wherever possible. Limits of excavation/extraction shall be clearly defined and marked to prevent damage by excavation/extraction equipment. Permanent vegetation and structures for erosion and sediment control shall be installed as soon as possible. Adequate provision shall be made for long-term maintenance of permanent erosion and sediment control structures and vegetation. No topsoil shall be removed from the area outside the excavation/extraction limits unless approved by the EPA.

C. Biodiversity

- 8.6 Vegetated will be replanted once extracted. Further, construction will occur in a manner slow enough to ensure that animals can move to other locations, even though there are very few faunal species in the location.
- 8.7 Particular attention will be paid to vulnerable or conservation-worthy plants and animal species that may be affected and conservation measures will be enforced in consultation with the EPA Biodiversity Unit and the Wildlife Division. Wildlife will be restricted access to fuel depot areas by erecting fences around the perimeter of these locations. In addition, all discharges from these facilities will be monitored to ascertain those discharges are safe for fish, as well as people.

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

D. Protection of Water Quality

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

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

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

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

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

E. Waste Management

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

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

F. Workers Health and Occupational Safety

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

- Occupational Hygiene,
- Illness and Infectious disease prevention and management, and
- Sewage and all types of waste disposal.

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

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

Dust Exposure

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

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

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

Noise

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

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

Heat

- 8.18 Measures to decrease the effect of increased exposure to heat will include working with adequate protective clothing to reduce the effect of heat stroke and skin cancers.
- 8.19 Implementation of the management program for health and safety of employees will coincide with the commencement of construction activities and will last through work on project closure. The contractors and the PMU will be responsible for its implementation and the costs for implementation are part of the project costs.

G. Workers Education and Awareness

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

H. Community Health and Safety

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

I. Community Education and Awareness

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

A. Promotion of Gender Equality

- 8.24 This program is not expected to have any significant impact on gender equality. Nevertheless, it should continue to be monitored to ascertain that the program does not deviate from the a priori

expectations. This will be the responsibility for the Ministry of Human Services and Social Security and the PMU.

B. Disaster Risk Management

- 8.25 The main disasters that the project will face are localized flash flooding, droughts and fires set by squatters. The project is not anticipated to exacerbate these but may be impacted by these, nonetheless. As such, it is imperative to treat with these using adequate and pragmatic mitigation measures. As regards localized flash flooding, the project should ensure that the project site is well equipped with functioning and effective drainage systems. Further, the construction of all structures should adhere to the building standards of Guyana, where elevated structures are always recommended along the coastal plain. This would ensure that the project does not have to face the constant scourge of flooding that can weaken the foundation of structures, lead to water contamination if the chemical bonds and gas storage facilities do not adhere to these standards, damage valuables and result in the spread of water-borne diseases.
- 8.26 Concurrently, the project has little control over droughts but given that all the climate models are indicating more extreme El Nino type weather events unless there is a drastic cut in greenhouse gas (GHG) emissions, then it is contingent upon the project to plan accordingly. In this sense, the complex should be outfitted with a redundant freshwater storage facility. This facility should remain full at all times and will be utilized during the dry season. Monitoring this facility will be the job of the GWI, Ministry of Health, and the GNBS.
- 8.27 Lastly, the GFS indicated that approximately 2 to 3 years ago fire was known to occur in the Sophia squatting and adjoining areas. The Fire Prevention Officer posited that approximately 80% of these fires were caused by humans. These fires were started largely to clear the area for security and land development purposes. This approach was often viewed as most cost effective. It will be imperative that the natural fire breaks be observed, public education about fire prevention ramped up, and that the facility have fire mitigation facilities.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

A. Environmental Management System to be implemented

- 10.1 This Environmental and Social Management Plan (ESMP) for the construction of the new GNBS Complex has been prepared in compliance with requirements of the Terms of Reference of the Inter-American Development Bank (IDB), IFC Environmental, Health, and Safety (EHS) Guidelines, and the Guyana Environmental Protection Act. For projects of this type, an authorization/"permit" is required from the Guyana Environmental Protection Agency (EPA). A meeting was held with the EPA on August 3, 2016, at which the Project was discussed. Representatives from the EPA stated that the project would require a permit. The application form for this permit has to be completed by the Bank, along with a sketch of the Project and submitted to the EPA.
- 10.2 The Client is committed to enforcement of the stipulations contained within the ESMP dictated by Guyana's EPA regulations and those of other bodies for environmental and social management of built development projects. Further, the GNBS is prepared to adhere to regulations which may be more stringent than those identified, if adequate technical justification is provided for those standards and provided that those standards do not compromise the economic viability of the proposed action. The GNBS will hire an Environmental, Health and Safety (EHS) officer. That officer will have specific responsibility for enforcement and for adherence to and compliance with EHS issues and for implementation of the ESMP.
- 10.3 The ESMP incorporates protection, mitigation and enhancement measures. The avoidance and mitigation measures include:
- ✚ Engineering designs and disposal techniques,
 - ✚ Pollution control, recycling, and monitoring of scientifically sensitive areas and resources, and
 - ✚ Enhancement of the physical environment, where possible, and stakeholders' involvement.
- 10.4 Additionally, the ESMP outlines a separate monitoring framework to assess the effectiveness of the Plan over time. The monitoring framework will determine whether the ESMP requires reorienting, based on changed conditions or factors not necessarily accounted for in the Plan. The ESMP's purposes therefore are:
- ✚ to reduce the risks of adverse impacts that may be associated with the project on environmental resources, and
 - ✚ to minimize disturbance to local stakeholders and/residents.
- 10.5 The national environmental regulation, the Inter-American Development Bank's (IDB) requirements and socio-physical environment are described above. As such, no further discussion on the project's justification and importance are deemed necessary. However, it is important to elaborate that the application of the EHS Guidelines is to outline the performance levels and measures that are normally acceptable to IFC, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology.
- 10.6 The EPA Guidelines for Environmental Assessment identify that developers should demonstrate within their environmental management plans that they have an objective to meet the ISO14000

standards. It is expected that the contractor would have an Environmental Policy in place that should accompany their site specific environmental management plan.

- 10.7 The ISO14000 series of international standards have been developed for incorporating environmental aspects into operations and product standards. In September 1996, the International Organisation for Standardisation finalised the ISO 14001 standards for environmental management systems. Similar to the Quality Management System (QMS) implemented for ISO 9001, the ISO 14001 requires implementation of an environment management system (EMS) in accordance with defined internationally recognised standards (as set forth in the ISO 14001 specification).
- 10.8 As with ISO9001, the key to a successful ISO14001 EMS is having documented procedures that are implemented and maintained in such a way that successful achievement of environmental goals, commensurate with the nature and scale of activities, is promoted. In addition, the EMS must include appropriate monitoring and review to ensure effective functioning of the EMS and to identify and implement corrective measures in a timely manner. It is only within the context of this certification that compliance with the environmental social management plan for this project can be assured. Many of the procedures outlined in the following sections are inherently part of an environmental management quality control system.
- 10.9 From baseline information collected during the preparation of the ESA potential impacts were identified that will require mitigation, through best practice during construction and operation of the GNBS complex, or through special measures employed as part of the contracted work. Impacts on the environmental components have been categorized into positive and negative impacts and further into direct (noise and dust pollution) and indirect impacts (improvement in amenities due to the construction of the complex). Additionally, it is important to distinguish between short- and long-term impacts occurring during the construction and operational phases of the project.
- 10.10 Activities to be carried out during each stage of development are further divided into:
- Detailed design mitigation;
 - Implementation/installation of mitigation measures;
 - Response to incidents or unforeseen issues arising e.g., spills, emergency situations, chance finds (construction stage only);
 - Routine daily and weekly inspections;
 - Review of ESMP and Construction Environmental Management Plan (CEMP);
 - Performance and compliance monitoring and response to any corrective actions;
 - Reporting – Daily Inspection Logs, weekly reports, monthly reports and quarterly reports in conjunction with Contractor's project management administration procedures.
- 10.11 The ESMP should be applied as a document that provides direction on the management of the environment and social relationships to construction, inspection and management personnel throughout the construction and operational phases of the project. The ESMP sets out the condition that the project is expected to follow to meet legislation, regulations and best practice for sustainable management of the project. The goal of the ESMP, therefore, is to reduce adverse impacts on both the physical environment and affected stakeholders as identified in the ESA. This ESMP is a legally binding document and the actions contained therein are expected to be followed by the Contractor(s), who will need to demonstrate their commitment through the adoption of this

ESMP and the development of a CEMP for the stages of the project, for which they have responsibility.

- 10.12 The Contractor(s) will need to include the compilation, implementation and the administration of the ESMP on the site, including training of the site team on their environmental duties and responsibilities. For ease of reference, a summary of environmental positive impacts and negative impacts which will require mitigation are highlighted below and reflected in [Table 13](#). Furthermore, for ease of reference, the issue is first identified, followed by a discussion of the mitigation measure and who will be responsible for executing the specific mitigation measure(s).

Table 13: Summary of the Potential Impacts during the Construction and Operation of the GNBS Complex

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

Medium	Impact	Type of Impact (Direct[D]/ Indirect[I])	Mitigation/ Enhancement/ Avoidance	Phase	Design Requirement	Procedures for execution	Responsible Entity/ Individual for Mitigation	Budget
						collected and stored to be exported.		
	2. Contamination of soil profile from toxic waste from construction material/fuel/lubricants/detergents etc.	D	Manage the containment of materials, fuel storage, and equipment with efficient prevention measures in place	Construction and operational	None	Identify best practice within site methods and supply adequate covering materials, bonding facilities for long term storage of any fuels, oils, or chemical shelters to avoid any potential combustion of heat/light sensitive materials. Further, work with the M&CC to determine the elevation off the ground for the chemical bond	Contractor, EMS & Client	
	3. Soil erosion from land clearance for storage of raw materials, construction camps and laying foundation	D	Utilize an area already denuded as construction site and clear only spaces needed for construction activities	Construction	None	The site most suitable for the placement of storage and workers camp will be identified	Contractor & SC	
	4. Reduced productive capacity of soils	D	Ensure that as much green spaces are retained as possible	Operational	None	Follow best practices during the operations of facility to maintain its environmental integrity	Client	
	1. Possible increased flooding due to water diversion and increased run off	D	Conduct thorough site survey to determine the number of culverts that will possibly need to be installed and maintain watercourses flow potential through inspection and regular clearance	Construction and Operational	Design specifications to identify the most reasonably practical place to locate any new culverts	Retention basis will be placed strategically along the project site to trap sediments in surface water before discharge	Contractor, SC and EMS	Included in contract bill of quantities

Medium	Impact	Type of Impact (Direct[D]/ Indirect[I])	Mitigation/ Enhancement/ Avoidance	Phase	Design Requirement	Procedures for execution	Responsible Entity/ Individual for Mitigation	Budget
Water Resources	3. Increased flooding due to intense rainfall and/or overtopping at the EDWC	D	Adhere to the M&CC and CH&PA building codes	Operational	Design structures to reduce the risk of flooding by adhering to national building codes and standards	Applications and design specifications to be approved by the M&CC and CH&PA. Additionally, the NDIA will install early-warning systems at the EDWC and continue to rehabilitate outfall canals, i.e., Hope, Cunha and Maduni	Contractor, Client, NDIA, M&CC and CH&PA	Included in contract bill of quantities
	3. Water Pollution from suspended solids and spillage	D	Application of best practices, such as lining pits with flexible impervious membrane	Construction	None		Contractor, SC & EMS	
	4. Reduction in aquifer recharge rates	D	Application of best practices through leaving as much green spaces as possible to allow for percolation of water	Construction	None	Design application is cognizant of this requirement	Contractor	Part of contract
	5. Increase in drought conditions that can lead to water scarcity at the facility	D	Construct redundant water facility	Construction	Modify design to include rainwater harvesting and water storage tanks	Design specifications modified based on climate models and information from the Hydrometeorological Department (HD) to assess future demand for water	Contractor and Client	Cost for the construction of the water harvesting and storage facilities
Biodiversity	1. Damage to ecology from construction works	D	Use best practices to reduce the impact on the environment	Construction	None		Contractor	
	2. Effect on aquatic life	I	Mitigate foreign material getting into the waterways	Construction and Operational	None	Have clearly marked waste disposal bins for waste separation and collection	Contractor and Client	
Socio-Economic	1. Congestion of the roadway, particularly at peak hours	D	Road users should be provided advance notice in a clear, timely and culturally appropriate manner via various media (TV, newspaper, radio, roadway signage, etc.).	Construction and operational	None	Advanced notice periods to be agreed	Contractor and GPF	Cost for notices in the local press

Medium	Impact	Type of Impact (Direct[D]/ Indirect[I])	Mitigation/ Enhancement/ Avoidance	Phase	Design Requirement	Procedures for execution	Responsible Entity/ Individual for Mitigation	Budget
Labour and Working Conditions	2. Increased traffic through side streets	D	The contractor, in collaboration with the Guyana Police Force will establish an effective Traffic Management Plan (TMP)	Construction and operational	None	Proper signage and notices to be instituted	Contractor, & GPF	Cost for notices in the local press
	3. Road safety concerns	D	The TMP will consider safety along main carriage way as well as through areas of ADI and All. Measures will include proper signage, pedestrian walkways and notices	Construction and operational	None	Advance notice period to be agreed with the Contractor	Contractor, GPF, SC	
	4. Deterioration of side streets	I	Restrict access through some side streets and enforce the TMP	Construction and operational	None	Prior notice to the members of the public in the print, electronic and voice media	Contractor & M&CC	
	5. Security concerns	D	Fence the construction site and install no go zones. Hire vigilant security officers	Construction and operation	Include a fence in the design	Increased signage with regards to the zonation of the site.	Contractor and PMU	To be determined
	6. Impacts on users of the facility including access reduction and restrictions	D	Implement the Stakeholder Engagement Plan and the GM (Annex 3)	Construction	None	Increased signage with regards to the zonation of the site	Contractor and PMU	
	1. Exposure to several hazards that could result in illness, injury or death such as due to workplace injuries, improper use of PPE or COVID-19 related illness.	D	Implement the mitigation and management measures in the LMP (Annex 3)	Construction and operation	Water stations, sanitation facilities on construction site, workers specific entrance and exists	Listed in the LMP	Contractor and the PMU	Included in the ESMP and ESS costs

Medium	Impact	Type of Impact (Direct[D]/ Indirect[I])	Mitigation/ Enhancement/ Avoidance	Phase	Design Requirement	Procedures for execution	Responsible Entity/ Individual for Mitigation	Budget
	2. Unfair treatment or discrimination based on personal characteristics unrelated to job requirements, such as race, gender, religion and sexual orientation is a risk of the project especially the physical works. These risks apply to all project workers, including those employed by the PMU.	D	Implement the mitigation and management measures in the LMP especially Code of Conduct and Local Labour Laws and Grievance Mechanism (Annex 3)	Construction and Operational	None	idem	Idem	Idem
	3. SEA/SH ⁴ Impacts including human trafficking and sexual relationships with minors.	D	All project workers' contracts will include a CoC (Annexe 3) with SEA/SH provisions and the PIU will monitor compliance. Project workers will be provided GBV orientation. SEA/SH considerations are included in the GRM for project workers, in the form of maintaining a list of SEA/SH service providers.	Construction and Operational	None	idem	Idem	Idem

⁴ refers to inappropriate or criminal behaviour, such as sexual harassment SEA/SH of a person, exploitative sexual relations, and illicit sexual relations with minors from the local community. SEA/SH also includes any exploitative sexual relationships and human trafficking whereby women and girls are forced into sex work.

Medium	Impact	Type of Impact (Direct[D]/ Indirect[I])	Mitigation/ Enhancement/ Avoidance	Phase	Design Requirement	Procedures for execution	Responsible Entity/ Individual for Mitigation	Budget
	4. Physical, psychological or sexual harassment of project workers	D	<p>The project will adopt a zero-harassment policy for all workers, reflected in the CoC and to be broadcast to all workers through various media and formats. The CoC will be integrated into contracts of all. The project GRM will be available to all Project workers.</p> <p>Awareness raising and training will be conducted for all Project Workers reviewing the terms and conditions of these procedures and tools.</p>	Construction and Operational	None	Idem	Idem	Idem
	5. Child and Forced Labour	D	<p>Certification of labourer's age using legally recognized documents.</p> <p>Awareness raising of the CoC, careful monitoring, and strict enforcement of compliance.</p> <p>Where persons under the age of 18 but above the 16 years of age are hired, the project will maintain a register containing the dates of their births and the type of work they provide in line with ESP52, and with the Employment Act (Annexe 3)</p>	Construction and Operational	None	Idem	Idem	Idem

Source: ESA, 2018

B. General Roles and Responsibilities

10.13 *Tables 14 and 15* outline the administration roles and responsibilities of the client and its representatives, regulatory agencies, and Contractor in the preparation and detailing of protocols to be followed during the construction and operational phases of the project. Many of these protocols will be done in consultation with other stakeholders, such as the private sector, residents, and the taxi and mini-bus associations. These roles and plans should be agreed by all parties prior to the commencement of any contract activities. This ESMP is a transitional document and aspects may be adjusted based on review and changed conditions in the field.

Table 14: Key Role and Responsibilities for Environmental Management of the Project

Role	Lead Responsibility
PMU Project Manager	<ul style="list-style-type: none"> Overall Management of the Project and main liaison with GoG and IADB. Oversee project and meet regularly with key members of the Supervising Consultant and his team and the Contractor's Project Management team and provide feedback to the Client and the GoG. Attend public consultation meetings as required.
PMU Environmental Engineer	<ul style="list-style-type: none"> Overseeing that the overall implementation of the ESMP. Undertake regular inspections on a discretionary basis of all areas of the works, site offices, compound, storage of materials areas and general provisions for environmental management during pre-construction and construction activities. Conduct reviews to ensure reporting and monitoring systems are in place and being maintained and recorded appropriately. Recording any incidents that require corrective actions which could be recorded as non-compliance. If the action is not corrected within the dedicated timeframe, the EE will write the Contractor on this formally. Be consulted on any departure from the stipulations of the ESMP. Follow up visits to be undertaken to check actions have been carried out appropriately. Attend regular meetings with other environmental representatives from Contractor and Consulting organisations. Attend regular project management meetings.
Supervising Consultant	<ul style="list-style-type: none"> Maintain administrative overview and design, review and monitor inspection reports and identify actions to Contractor. Audit the Principal Contractor's Construction Environmental Management Plan and activities associated with strategic plans and method statements and compliance with the Contract Specification, local regulations and the ESMP. Maintain inspection reports. Provide weekly reports to the Client Hold regular meetings with the Contractor's Environmental Inspector and the GNBS Environmental representative and others as required. Ensure compliance and performance monitoring of the ESMP are conducted as stipulated in the ESMP. Monitor compliance with the engagement of the public in accordance with the Communication Plan.
Construction Contractor Project Manager	<ul style="list-style-type: none"> Contractor responsible for compliance with Quality Environment and Safety, and the full implementation of the ESMP.
Contractor's Environmental Manager	<ul style="list-style-type: none"> Reports to Contractor's Project Manager and the Supervising Consultant Environmental.

Role	Lead Responsibility
	<ul style="list-style-type: none"> • Regular daily site inspections of all work areas and reporting as required for corrective actions. • Training new team members on any environmental aspects and specific tool box talks for site specific activities e.g., occupational health and safety, etc. • Coordinate all environmental quality testing as required by the ESMP. • Provide monthly reports to the Project Manager which will include training and induction records; incident reports and reports /complaints by the public inclusive confirmation of actions taken. • Maintain waste management records – materials and domestic waste management. • Implement with the Contractor’s site team adherence to the strategic plans - Traffic Management Plan, Communication Plan, Emergency Response Protocols and general environmental best practice. • Prepare site specific or standard generic methods for the site team to adhere to for working near watercourses. • Implement the ESMP in full. • Agree hours of working to meet accepted noise and vibration limits in consultation with GNBS and EPA. If there is to be a variation in the agreed times, must write the GNBS and the EPA for written consent well in advance so the public can receive at least two (2) weeks notice in advance of the deviation.

