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Inter-American Development Bank
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Washington, DC 20577

Environmental and Social Assessment for the Guyana Access to Resilient Housing, Basic Infrastructure, and Mobility Services (GY-L1031)

10 August 2017

Environmental Resources Management
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Washington, DC 20006

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Project No. 0412861
Guyana



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EXECUTIVE SUMMARY

In May 2017, the Government of the Cooperative Republic of Guyana (GOG) officially requested for the Inter-American Development Bank (IDB) to reformulate the 2012 loan operation “Road Network Upgrade and Expansion Program” (GY-L1031) to include a component addressing housing and basic infrastructure needs of low-income populations in social housing schemes in the greater Georgetown area. The reformulated program, labeled the “Adequate Housing and Urban Accessibility Program” requires development of an Environmental and Social Analysis (ESA) to support approval of the reformulation.

The reformulated housing and urban development component will be executed by the Central Housing and Planning Authority (CH&PA), part of the GOG’s Ministry of Communities. This component will follow a Multiple Works approach, which, under Bank loan guidelines, identifies a “sample” investment project for execution, which is then followed by other interventions which follow previously approved operations regulations and environmental and social safeguards guidelines. The proposed sample project will be located in the area of Sophia, in central Georgetown.

ERM, in coordination with CH&PA and the Bank, conducted a targeted ESA for the Program community of Sophia. The ESA was aimed at identifying potential environmental, social, health and safety (ESHS) risks and developing recommendations to mitigate and manage such risks via a Program-specific Environmental and Social Management System (ESMS).

The assessment focused primarily on the high-priority anticipated impacts of loss of livelihoods, impacts to community services and infrastructure, and natural disaster risk. Other impacts considered in the ESA, and for which mitigation and management measures are proposed as appropriate, include impacts to air quality, noise, environmental contamination, community health and safety, and biodiversity.

Given the Program’s location in Guyana’s flood-prone coastal plain, a Disaster Risk Management Plan (DRMP) has been developed as part of the Program’s ESMS and identifies measures to improve the resilience of the Sophia Program area to disaster risks.

Depending on the final infrastructure interventions selected for the Sophia site, temporary or permanent economic displacement could occur. As such, the need for a Livelihood Restoration Plan (LRP) should be confirmed at such time that the information on the interventions becomes available, and an LRP developed in accordance with the Program’s Environmental and Social Management Framework (ESMF) if required.

1.0 INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

In May 2017, the Government of the Cooperative Republic of Guyana (GOG) officially requested for the Inter-American Development Bank (IDB) to reformulate the 2012 loan operation “Road Network Upgrade and Expansion Program” (GY-L1031) to include a component addressing housing and basic infrastructure needs of low-income populations in social housing schemes in the greater Georgetown area. The reformulated housing and urban development component will be executed by the Central Housing and Planning Authority (CH&PA), part of the GOG’s Ministry of Communities.

Approval of the reformulation necessitates an Environmental and Social Analysis (ESA) for a sample of the housing and infrastructure component of this multi-works Program. The Program will be designed to improve quality of life and facilitate further community and economic development in the selected communities through delivery of quality housing and basic infrastructure solutions. The affordable and sustainable housing sub-component (\$10M) will consist of subsidies designed for low-income households in the Georgetown area, for: (i) housing improvement; and (ii) construction of core homes on existing serviced lots. The infrastructure sub-component (\$18M) will finance completion or rehabilitation of infrastructure and services on housing sites in the Georgetown area. Specific investments will be tailored to local conditions and include: (i) secondary road maintenance and rationalization; (ii) climate-ready drainage; (iii) power and water supply; and (iv) community facilities on earmarked publicly-owned lands that will include gender considerations regarding access and use.

This document presents an Environmental and Social Assessment (ESA) for a sample community that will be targeted for the Program, namely the community of Sophia, and focuses primarily on the infrastructure sub-component of the proposed loan. The ESA is a requirement for IDB-supported projects; while it is anticipated that the Program would represent an overall benefit to the community, the potential exists for environmental and social impacts to occur, and this document seeks to identify these potential impacts and recommends an environmental and social management framework to be put into place to mitigate, manage, and monitor these impacts and risks for the life of the Program.

1.2 OBJECTIVES AND SCOPE

ERM has been contracted by the IDB to prepare an ESA for the infrastructure sub-component of the Program that will be implemented in the community of Sophia. This document identifies potential environmental and social risks associated with Program activities in Sophia, and has been developed based on the following:

- Review of relevant documentation including draft Project Profile document, previously completed ESA for the transportation component of the original GY-L1031 Program, community development plan for Section D Sophia, and reports and data from relevant government agencies (e.g. Ministry of Public Infrastructure, Ministry of Communities, Guyana Meteorological Service)
- A site reconnaissance including visual observation of the areas likely to be directly and indirectly affected by the Program, key informant interviews with relevant individuals, groups and organizations, and a group meeting with Sophia community leaders.
- Evaluation of the legal and regulatory framework applicable to the Program, including IDB requirements.
- Assessment of the potential environmental, social, cultural, health and safety, and labor impacts and risks associated with the Program, and the planned urban interventions; focusing primarily on livelihoods; flood risk; infrastructure and services, and other risks.
- Recommendations for mitigation, management and monitoring plans required at the level of the Program, in an Environmental and Social Management Framework (ESMF).

1.3

PROGRAM DESCRIPTION

Sophia is located in Region 4 of Guyana, and is part of the developed urban area of the Guyanese capital city of Georgetown. While the complete set of areas for intervention will be selected according to approved project criteria and guidelines under the reformulated operation, Sophia will be included as the starting sample project. Potential sites are illustrated in Fig. 1-1 below.

Figure 1-1: CH&PA housing schemes under consideration for Program Inclusion



Source: IDB, 2017

Sophia is a densely populated (estimated population 32,000), primarily residential zone located on former Guyanese Sugar Corporation (GUYSUCO) lands. It originated as a squatter community that has been undergoing a process of regularization since the mid-1990s. It is generally divided into seven sections (see Figure 1-2 below).

Figure 1-2: Sections within the Sophia Housing Scheme



Source: CH&PA, 2017.

The proposed interventions in the Sophia sample community will consist of the following:

- 20 km of asphalted concrete roads;
- 7 km of reinforced concrete drains;
- 6 km of reinforced concrete sidewalks;
- 2 playgrounds/community centers; and
- Streetlighting.

The exact locations for the proposed works are shown in Figure 1-3 below.

Figure 1-3: Locations of Proposed Works in Sophia



Source: CH&PA, 2017

For the purposes of this ESA, relevant, available secondary information applicable to the Sophia community was obtained from the CH&PA and other government ministries and agencies¹. The community was visited as part of the site reconnaissance mission to document visual observations, and a consultation meeting was held with community leaders to inform them of the Project, gather general information on the community, and seek input on the organization of future consultation events.

¹[Bureau of Statistics Guyana, Guyana Hydrometeorological Service, Guyana Environmental Protection Agency, Ministry of Public Infrastructure.](#)

2.0 *METHODOLOGY*

2.1 *DOCUMENT REVIEW*

To understand the Program's context and also support in the assessment of potential socioeconomic and environmental effects, relevant documentation has been reviewed. Key documents include:

- Draft IDB Project Profile Reformulation for GY-L1031
- Sheriff Street-Mandela Avenue Roadway Design Project ESIA
- East Bank Development Strategy
- Sophia Section D (Turkeyen) Community Development Plan
- IDB Guidelines on Meaningful Stakeholder Consultation
- CH&PA Approach to Enabling Positive Community Change through Community Participation
- National Integrated Disaster Risk Management Plan for Guyana

Secondary data and information was also obtained from relevant national and international bodies and publically available databases.

2.2 *SITE RECONNAISSANCE*

ERM experts visited Georgetown from 20-23 June 2017 to conduct key informant interviews with and collect documentation from relevant government agencies and complete drive-through visits of the communities of interest. This provided an initial overview of the site context and the key environmental and social issues which are discussed further in forthcoming sections.

2.3 *MEETING WITH COMMUNITY LEADERS*

ERM's social specialist attended a meeting organized and led by CH&PA with community leaders in Sophia to gather context-specific information about the community's challenges, opportunities, and priorities. This provided helpful contextual information to validate and supplement desktop research and site reconnaissance observations.

3.0 **ADMINISTRATIVE FRAMEWORK**

This chapter summarizes Guyanese legislation and policies in Guyana that are applicable to the Program, as well as the IDB Safeguard Policies that are applicable to the Program.

3.1 **NATIONAL LEGAL FRAMEWORK**

This section provides an overview of the national environmental and housing and infrastructure-oriented legislation currently in force in Guyana that could apply to the Program.

National Constitution of Guyana

Guyana is governed according to the Constitution of the Co-operative Republic of Guyana, as amended. The constitution took effect in 1980 and expressly provides for protection of the environment. Article 25 establishes “improvement of the environment” as a general duty of the citizenry. In addition, Article 36 reads as follows:

In the interests of the present and future generations, the State will protect and make rational use of its land, mineral and water resources, as well as its fauna and flora, and will take all appropriate measures to conserve and improve the environment.
(OAS, 2013)

Environmental Protection Act

In 1996, the Environmental Protection Act (the Act) was ratified to implement the environmental provisions of the Constitution. The Act is Guyana’s single most significant piece of environmental legislation because it articulates national policy on important environmental topics such as pollution control, the requirements for environmental review of projects that could potentially impact the environment, and the penalties for environmental infractions. It also provides for the establishment of an environmental trust fund. Most importantly, the Act authorized the formation of the EPA, and establishes the EPA as the lead agency on environmental matters in Guyana (FAO, 2013). The Act further mandates the EPA to oversee the effective management, conservation, protection, and improvement of the environment (EPA, 2012). It also requires the EPA to take the necessary measures to ensure the prevention and control of pollution, assessment of the impact of economic development on the environment, and the sustainable use of natural resources.

Environmental Protection Hazardous Waste Management Regulations

These regulations outline rules and procedures for the transport, storage, treatment and disposal of hazardous substances, with the intent of protecting human health and the environment. For the purposes of these regulations, hazardous materials and wastes are:

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

Environmental Protection Air Quality Regulations

These regulations require that any operation emitting air contaminants during the construction, installation, operation, modification or extension of any facility relating to industry, commerce, agriculture or any institution must apply to the EPA for an environmental authorization. The regulations also stipulate that the EPA shall establish emission limits for specific parameters; however these have not been established to date and the International Finance Corporation's (IFC) Environmental, Health and Safety

Guidelines(<https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final+-+General+EHS+Guidelines.pdf?MOD=AJPERES>) are used.

Environmental Protection Water Quality Regulations

These regulations require registration and environmental authorization for construction, installation, operation, modification or extension of any facility that will cause the discharge of effluents. The regulations include parameter limits for concentrations of specific constituents which can be discharged into any inland or coastal water or lands in Guyana.

Environmental Protection Noise Management Regulations

These regulations require operations that emit noise to apply to the EPA for an environmental authorization, and also establish permissible noise levels for specific types of land uses such as residential, institutional, educational, industrial, commercial, construction, transportation and recreational.

Town and Country Planning Act

This Act makes provision for the orderly and progressive development of land, cities, towns and other areas both urban and rural. The Act provides

development guidelines for the built environment and is enforced by the Ministry of Communities' Central Housing and Planning Authority (CH&PA).

Regional and Neighbourhood Democratic Councils

The Local Domestic Organs Act, amended in 2006, divides Guyana into 10 regions each with their own Democratic Council (RDC), 33 Neighborhood Democratic Councils (NDCs), and 76 Amerindian Village councils for the purposes of administrative management. The RDCs have some level of autonomy, although they are under the purview of the Ministry of Communities.

Water and Sewerage Act

This Act provides for the ownership, management, control, protection and conservation of water resources, provision of safe water and sewerage services, and regulation thereof. The Act establishes Guyana Water Incorporated (GWI), a merger of the previous bodies Guyana Water Authority and Georgetown Sewerage and Water Commissioners. The Act also defines fines for offenses relating to wastage, tampering, damage and pollution to waterworks.

Labour Act

The 1942 Labour Act and its regulations specify the conditions that an employer must observe in the hiring of employees, including terms of payment. The Act also provides for prevention of discrimination and outlines conditions for the employment of young persons and children.

Occupational Health and Safety Act

The 1997 OHS Act regulates the registration and regulation of industrial establishments, and legally defines the responsibilities of workers and management with respect to keeping workplaces safe.

3.2 NATIONAL POLICY FRAMEWORK

Guyana's government has articulated national policies on several environmental, social and development topics that are relevant to the Program. This section provides an overview of the key government policies applicable to the Program.

National Development Strategy

The National Development Strategy 2001 - 2010 (NDS) recommends priorities for Guyana's economic and social development policies. The document contains technical analysis of problems and future prospects in all sectors of the economy and in areas of social concern. A number of the priorities highlighted in the NDS are directly relevant to the Program, including transport infrastructure, housing, urban development and environment, as well as poverty eradication and gender equity (NDS, n.d.; <http://www.ndsguyana.org/downloads.html>).

National Environmental Action Plan

Guyana's National Environmental Action Plan (NEAP) articulates the national government's approach to managing the environment from the perspective of economic development. The NEAP considers the issues of environmental management, economic development, social justice, and public health to be inextricably linked. It identifies deforestation, pollution, and unregulated gold mining as historically minor but growing environmental problems, while identifying the country's most serious current environmental problem as being the relatively small, vulnerable area of the coastal zone where most of the population and physical assets are concentrated (<http://documents.worldbank.org/curated/en/268421468771041163/Guyana-National-environmental-action-plan>).

The NEAP is directly relevant to the Program in several ways. It identifies the coastal zone, where the Program communities are located, as an area in need of focused management due to the susceptibility of the coastal environment to both natural and human-induced degradation. It also identifies liquid and solid waste management, and establishment of national, regional and local institutions to improve environmental management as key priorities.

Integrated Coastal Zone Management Action Plan

Guyana's Integrated Coastal Zone Management (ICZM) process is an ongoing initiative to: promote the wise use, development, and protection of coastal and marine resources; enhance collaboration among sectoral agencies; and promote economic development. In 2000, after two years of study, the ICZM Committee produced an ICZM Action Plan, which was approved by the Cabinet in 2001.

The ICZM Action Plan addresses policy development, analysis and planning, coordination, public awareness building and education, control and compliance, monitoring and measurement, and information management (GLSC, 2006). Other coastal-zone related tasks currently being undertaken by the Government include: strengthening of the institutional setup for ICZM; a public awareness campaign to increase public understanding of the vulnerability of the coastal zone to sea level rise and climate change; and the creation of a database of coastal resources to facilitate improved ICZM. Currently, the EPA is mandated to coordinate the ICZM program and coordinate the development of the ICZM Action Plan through the ICZM Committee.

Under the Caribbean Planning for Adaptation to Climate Change (CPACC) Project, Guyana has conducted a socioeconomic assessment of sea-level rise as part of a wider vulnerability assessment and developed a Climate Change Adaptation Policy and Implementation Strategy for coastal and low-lying areas.

The IDB has a list of environmental and social safeguards, which serve as the standard to which environmental and social performance on the part of funding recipients is evaluated against. The safeguards provide guidance as to the best-practice implementation of projects. Table 3-1 details the guidance relevant to the activities associated with this Program.

Table 3-1: IDB Safeguards

Policy/Directive	Applicable aspect	Performance Indicators
IDB B1: Bank Policies	Environmental Management and Resource Management Operation	Borrower/Executing Agency has legislation in place that promotes environmental management, training, and environmental governance and also promote conservation and sustainable use of natural resources
IDB B2: Country Laws and Regulations	Project Design	Program will comply with Guyana ESHS laws and regulations.
IDB OP-703: B.4 Other Risks	Governance capacity	Borrower/Executing Agency should exhibit institutional capacity for managing environmental and social issues.
	Disaster risk	A review of Program location is conducted to determine risk of being located in an area prone to disasters.
IDB OP-703: B.5	ESA and ESMP	Borrower/Executing Agency will complete an ESA including with a Social Assessment, and an ESMP, SEP and GMP.
IDB OP-703: B.6 IDB OP-102 International Best Practice	Consultation	Borrower/Executing Agency will develop a Stakeholder Engagement Plan that is scaled to the Program risks and impacts and development stage. The Borrower/Executing Agency will establish a grievance mechanism to receive and facilitate resolution of Affected Communities' concerns and grievances about the client's E&S performance.
IDB OP-703: B.7: Supervision and Compliance	Monitoring	Borrower/Executing Agency will ensure allocation of budget for monitoring activities.
IDB OP-703: B9	Natural Habitats and Cultural Sites	The Borrower/Executing Agency will not support operations that significantly convert or degrade critical natural habitats or that damage critical cultural sites.

Policy/Directive	Applicable aspect	Performance Indicators
IDB OP-703: B10: Hazardous Materials IDB OP-703: B11: Pollution Prevention and Abatement	Pollution Prevention	The Borrower/Executing Agency will put in place specific mitigation measures and management plans to ensure pollution prevention during the construction and operations phases (e.g. fuel spills).
IDB OP-703: B17 Procurement	Worker ESHS	The Borrower/Executing Agency will ensure contractor contracts include requirements for adherence to IDB ESHS requirements.
IDB OP-704: A2	Risk and Program Viability	The Borrower/Executing Agency will evaluate the risk profile of natural hazards related to the Program.
IDB OP-703	Community Health, Safety & Security	The Borrower/Executing Agency will evaluate the risks and impacts to the health and safety of the Affected Communities during the Program life-cycle and will establish preventive and control measures consistent with good international industry practice.
IDB OP-710	Resettlement	The Borrower/Executing Agency has done everything to minimize the need for physical and economic resettlement; if resettlement occurs, the impact is managed in such a way so as to ensure resettlement becomes a development opportunity.
IDB OP-761	Gender Equality	The Borrower/Executing Agency will ensure that the operation will not affect women or gender equality negatively; Program will offer opportunities to promote gender equality or women's empowerment.

4.0

IMPACT ASSESSMENT

This section presents an impact assessment of the main environmental and social risks that have been identified associated with the Program. Sections 4.1 to 4.5 focus on items considered to be high priority, namely potential loss of livelihoods, impacts to infrastructure and services, pollution of environmental media, and risks due to natural hazards. Section 4.6 then offers commentary on additional risks identified as part of this ESA study.

4.1

SOCIAL IMPACT - LOSS OF LIVELIHOODS

Baseline Conditions

Results of the most recent national census indicate that 87.5 percent of Guyana's labor force was employed and 12.5 percent was unemployed in 2012. Data from the previous census in 2002 indicate that the unemployment rate did not change in this 10-year period (BSG 2012; BSG 2002).

In 2012, Region 4 had an average unemployment rate of 11.3 percent. Census data show that tertiary² (service) sector jobs such as wholesale and retail trade, public administration, and accommodation and food services are dominant in Region 4 (including Georgetown), making up 67.0 percent of jobs there. Female representation in this sector is high, with women making up 48.2 percent of workers in the sector (BSG, 2016). Secondary and primary sector jobs make up 21.0 percent and 12.0 percent of employment in Region 4.

The population in Sophia is estimated at 32,000, accounting for about 10 percent of Georgetown's population. The unemployment rate within Sophia is not available but is anecdotally reported to be relatively high, particularly for youth. Sophia is historically a high poverty and working class neighborhood that originated as a squatter community in the 1980s but has been undergoing a process of regularization since the mid-1990s. This process has included granting of land ownership titles to some illegal squatter households, as well as allocation of vacant land parcels to moderate income professional and administrative workers such as nurses, police, teachers, and public servants. A number of people in the community are also self-employed, relying on informal construction work or yard work, small enterprises such as sewing, furniture-making, barbering or bicycle repair, or vending of food and other items. A number of illegally built structures on the drainage canals are business establishments of this nature, and various stands are also present at intersections throughout the community (Figure 4-1). Brick and mortar establishments on

² According to the BSG, the primary sector industries (e.g., agriculture, fishing, forestry, and mining) make direct use of natural resources and include the production of raw materials and basic foods. The secondary sector is engaged in manufacturing using raw products from the primary sector and includes processing, construction, textile production, brewing and bottling, etc. The tertiary sector provides services to the general population and businesses, including retail and wholesale trade, transportation and distribution, entertainment, tourism, healthcare, etc.

commercially designated land are also present, and include taxi stands, pharmacies, and carpentry workshops.

Figure 4-1: *Small-scale commercial establishments in Sophia*



Source: ERM, 2017

Other livelihood activities in Sophia include micro-scale agriculture (i.e. kitchen gardens on individual properties) and rearing of livestock such as chickens and goats.

Figure 4-2: *Small livestock grazing at the side of a main road in Sophia*



Source: ERM, 2017

Sophia has a youthful population, with 75% of the population reported to be under the age of 35 according to community leaders. School dropout rates, teenage pregnancy and the incidence of households led by single mothers are high, which contributes to a cycle of poverty.

According to the Guyana Police Force, parts of Sophia are considered crime hotspots with robbery and break and entry being the most prevalent problems. Sophia is one of twenty communities in Guyana participating in an IDB-funded program to reduce youth violence. This includes components on youth training

and capacity building; however according to community leaders, one of the issues with such initiatives is poor application and follow-up of the provided training, either because youth may leave the community, or because they are never able to put their training to use since there are few job opportunities locally. As such, development of local employment opportunities is prioritized as a major issue of concern in the community.

Impact Assessment

Construction phase

Program construction activities could disrupt some informal commercial activities occurring within the communities if the vendors' establishments (often small wooden stands or shacks) need to be moved either temporarily or permanently to make way for new infrastructure or for construction activities to take place. There is also potential for access to both informal establishments and formal brick and mortar establishments in the community to be temporarily restricted as a result of construction traffic congestion, temporary staging of building materials, and securing of active work zones.

Local livelihoods could also be affected if assets are accidentally damaged by Program activities, for example accidents involving livestock and Program vehicles/machinery.

Insufficient livelihood opportunities are currently available to Sophia residents, despite many having marketable skills. The Program has the potential to positively benefit local livelihoods by providing temporary employment to local residents during the construction phase.

Operations phase

Adverse livelihood impacts during operations are not expected to be minimal since any displacement of economic activities would have already occurred at the onset of construction. During operations impacts to livelihoods may in fact be positive since some of the proposed interventions such as road and drainage improvements, and addition of sidewalks could improve or maintain accessibility of local businesses to community residents.

Depending on the allocation of funding for the associated institutional strengthening component of this Program, the Program could also create limited permanent employment related to maintenance of the new infrastructure.

Conclusion and Recommendations

To minimize and mitigate adverse impacts on livelihoods, the following measures are recommended:

- 4. Develop an area-specific Livelihoods Restoration Plan using the Preliminary Livelihoods Restoration Framework provided in the overall Program Environmental and Social Management Framework document. This

framework outlines the process to conduct a census and survey of the commercial establishments and vendors in affected areas, which will form the basis for a plan to avoid potential impacts to the extent possible, or to appropriately compensate businesses if required.

- í Consider opportunities for community employment during Program construction and possibly during operations (e.g. maintenance, security). This can be done by including stipulations for contracted construction companies to hire a target percentage of workers from the local community.
- í Consider other forms of economic development initiatives within the package of interventions, or identify opportunities for coordinated investments across government programs, such as establishment of a market area, provision of land and training for specific income-generating agricultural activities, or support in establishing a community co-op. A program of engagement with the community would be required to identify the most suitable projects and interventions.
- í In all programs or policies for both direct Program employment and for longer-term economic development initiatives, ensure identification of opportunities to promote gender equality by providing employment and capacity-building opportunities for women.
- Establish a stakeholder engagement plan (SEP) to ensure that affected populations are provided the opportunity to voice any concerns relating to potential livelihood impacts well in advance of the Program's commencement.
- í Develop a grievance mechanism to ensure that affected populations have a reliable and consistent means to seek remedy in the event of unforeseen accidents that could affect their livelihoods (e.g. accidental damage to infrastructure such as vending stands, accidents involving livestock).

4.2

SOCIAL IMPACT - IMPACTS TO COMMUNITY SERVICES AND INFRASTRUCTURE

Baseline Conditions

Sophia has been undergoing a process of regularization since the mid-1990s. Given the large area of the community and the need for CH&PA and the Ministry of Public Infrastructure to apportion their investments over many other housing schemes, this process has been implemented in an incremental manner and many infrastructure and service needs still exist.

Transportation Infrastructure

The main roads in the community are paved while many of the internal roads remain unpaved and/or poorly maintained, and lack elements to improve pedestrian safety such as crossings and cautionary signage. According to a survey conducted for the Section D (Turkeyen) area of Sophia, the majority of

residents rely on public transportation and therefore walk on the community's roads daily.

Figure 4-3: *Potholed road in Sophia*



Source: ERM, 2017.

During the meeting with community leaders, participants noted a lack of interconnects such as bridges and footpaths to travel between different sections of the community, and noted that such infrastructure is needed to enhance community connectivity and safety.

Utilities

The majority of households in Sophia have electricity and piped water connections. However, some areas of the community are not yet regularized and lack these services. This includes an area in North Sophia referred to as the “Block R extension” where about 300 people currently reside and which lacks electricity, piped water, and roads.

Squatter settlements on the drainage canals also lack utilities, but there are no plans to service these areas as they are considered by the government as ‘zero-tolerance’ areas that are occupied illegally.

For areas that have connections, these are reported to be frequently vandalized by some of the individuals living in squatter households. For example, air valves are often removed from water lines to steal water, which creates both wastage and a point of contamination risk (GWI, 2017).

Recreation

During the planning of housing schemes, certain areas are earmarked for recreational uses such as playgrounds and community centers. However, it may take years for funds to become available to actually develop the facilities on the

earmarked lands. During the site reconnaissance, ERM noted a lack of adequate recreational spaces in the Sophia neighborhood despite the high proportion of youth. In addition, community leaders reported that many playgrounds that have been built are completely unused due to a lack of maintenance and upkeep. For example, many playgrounds are overgrown with vegetation because there is no source of routine maintenance, and some lack fencing, lighting or other features needed to maintain safety.

Sanitation

There is no community-wide waste disposal service in Sophia. Some residents pay for a private collection service, while others bury or burn trash on their properties. During the site reconnaissance ERM also observed evidence of illegal dumping throughout the community.

Figure 4-4: *Improperly managed solid waste in Sophia*



Source: ERM, 2017

There is no sewage system in Sophia. Many households make use of septic tanks, and others, including many of the squatter households along the drainage canal, use pit latrines. Some households do not have any sanitation infrastructure. There is no authority charged with assuring the proper installation and maintenance of septic tanks and latrines, and therefore there are concerns related to potential contamination of canals.

Drainage

Throughout the Project communities, overtopping of drainage canals and flooding of properties was observed after precipitation events. According to representatives of the Ministry of Public Infrastructure, greywaters, including septic tank effluent from most households discharges into the stormwater drainage canals. While the canals generally have sufficient capacity to accommodate these discharges along with stormwater, their capacity is compromised due to poor maintenance. Many drainage canals were observed to be clogged with overgrown vegetation, sediment, and garbage which contributed to the observed flooding. Furthermore, quality of the surface water flowing in these canals is thought to be poor since installation and maintenance of the septic systems is not regulated; it was also reported that some of the

squatter households use the canals (including the Lamaha Canal, from which potable water for the City of Georgetown is sourced) for washing and bathing.

Figure 4-5: *Flooded yards in Sophia*



Source: ERM, 2017

Law Enforcement

The Guyana Police Force (GPF) is responsible for maintaining security and order in the greater Georgetown area, including within the social housing schemes. During an interview, a representative of the GPF indicated that robberies and break and entries are the most prevalent crimes in all communities. They also noted that parts of Sophia are considered to be crime hotspots and therefore greater resources are deployed here. It was noted that there is generally insufficient manpower and other resources such as transportation in the GPF, which poses challenges to serving all areas of Georgetown adequately.

Impact Assessment

Transportation Infrastructure

Construction Phase

Program activities will generate traffic on local roads from the transportation of materials, workers and wastes associated with construction. This could add to traffic congestion and safety risks in the community. As in many areas of Georgetown, the main roads entering the community already experience congestion at various times during the day. Within the community, increased vehicle traffic, particularly of heavy construction trucks and machinery, could add to safety risks for road users, and could also cause damage to road surfaces. These potential impacts are of particular concern for the large number of pedestrians and cyclists in the community³.

³ERM observed a high level of pedestrian traffic during the site visit, and the 2013 Community Development Plan for the Section D Turkeyen section of Sophia notes that vehicle ownership in the community is low, and that public transport is the main mode of transportation for residents.

Improvement of the roads within the community will also cause temporary road closures creating disruption and diversion of traffic.

Operations phase

The consolidation and improvement of infrastructure in Sophia is likely to result in increased occupancy of the scheme over the medium to long term. This will result in an incremental increase in the burden on road infrastructure, potentially causing more damage to roads and increasing traffic congestion. However, the paving of 20 km of roads will increase traffic capacity in these specific areas. As such the Program is expected to have an overall beneficial impact during operations.

Utilities

Construction phase

At this time, the Program's source of power and water for construction activities are not known. If construction work requires use of the local utility networks, this could create temporary impacts on the quality of water and power service in the communities.

Operations phase

Operation of the Program is not expected to generate negative impacts, as it is assumed that the CH&PA will work with the relevant authorities (Ministry of Public Infrastructure, Guyana Power and Light, Guyana Water Incorporated) to ensure that system capacities are sufficient to meet the needs of newly developed lots in the housing scheme.

Recreation

Construction phase

Program construction activities could potentially affect access to existing recreational facilities in the community through road closures, increased traffic congestion, securing of work areas, or creation of dust, noise and other nuisance adjacent to the recreational facilities.

Operations phase

The Program is expected to have a net positive impact on recreation over the longer term since the package of interventions includes construction of two new playgrounds/community centers. Other infrastructure such as sidewalks and streetlighting will also promote a safer atmosphere which will be conducive to improved utilization of the community's recreational facilities.

Sanitation

Construction phase

Program construction activities could potentially affect sanitation conditions if excavation or dredging activities disturb contaminated ground, for example in areas adjacent to pit latrines or improperly maintained septic tanks.

Operations phase

The Program will ultimately lead to increased occupancy in the Sophia housing scheme. Given the lack of a sewage system, this is likely to mean the addition of more individual sanitation infrastructure which will add to sanitation risks in the community. This includes pit latrines that may be dug too close to drainage canals, and septic tanks that may be installed without proper filtration and/or improperly maintained. Contamination of groundwater from the septic tanks and latrines is also possible.

Drainage

Construction phase

Construction activities could adversely affect drainage if solid waste and run-off are allowed to enter drainage canals. Maintenance of the canals is already inadequate, leading to insufficient capacity to deal with heavy precipitation events.

Operations phase

Addition of more households in the housing scheme will also add an additional burden to the drainage system, since it is presumed that greywater from these households will be discharged to the existing network. If solid waste management practices are not improved, additional households are also likely to contribute to increased debris and pollution of the canals. This could exacerbate an already critical situation that already poses a public health risk in the community.

Addition of 7 km of reinforced concrete drains will improve drainage capacity and thereby reduce flood vulnerability in these particular areas.

Law Enforcement

Construction phase

Influx of workers associated with construction has the potential to affect community safety and sense of well-being, particularly if the worker population is non-local, and large in numbers compared with the host population. However, this impact is expected to be minimal or indistinguishable given the large baseline population in Sophia, and since it is not anticipated that the workforce would be large or made up of foreign nationals.

Operations phase

Addition of more households in the Sophia housing scheme will increase the overall population, which typically means an increase in law enforcement requirements for the area. However, some of the proposed interventions such as addition of street lighting and recreational facilities will promote safer conditions in the area which could result in less law enforcement resource requirements, over the long term.

Conclusion and Recommendations:

There are a number of gaps and shortfalls in public services and infrastructure in Sophia at baseline. The proposed Program will result in both adverse and positive impacts, with adverse impacts occurring primarily on a temporary basis during construction, while overall long-term impacts over the operations phase are expected to be largely positive. ERM recommends the following to minimize adverse impacts and optimize positive benefits:

- í Conduct a needs assessment of the Sophia area, including extensive stakeholder consultation, to ensure appropriate prioritization of community needs for the interventions and leveraging of potential synergies;
- í Ensure incorporation of pedestrian-friendly design and crime prevention through environmental design (CPTED) in all infrastructure development interventions;
- í Assess capacity of local power and water systems to meet Program construction needs; if resource shortfalls are expected during the construction timeframe, plan for use of diesel-powered generators and trucked water for construction needs;
- í Ensure advance notice to affected households in the event of planned water or power service interruptions; provide access to alternative sources of water/power if interruption is more than momentary;
- í Provide regular updates to the community on planned construction activities and schedule, including any instances of road closures and detours, or restricted access to community facilities, businesses or amenities;
- í Develop a Traffic Management Plan to be implemented by all contractors, which would include measures such as establishment of preferred routes, designated areas for worker parking, and scheduling of construction equipment/material deliveries to occur outside of peak traffic hours;
- í Survey road conditions prior to commencement of construction and ensure that roads are rehabilitated to the same or better condition after construction;
- í Establish an Access Management Plan, which would maintain continuous access for critical community facilities for pedestrians and even vehicles if necessary through careful staging and sequencing of construction activities
- í Maintain communication with the Guyana Police Force and local authorities to ensure an appropriate level of law enforcement presence both during construction, and operation of the Project;
- í Establish local hiring targets and incorporate these into construction contract requirements.

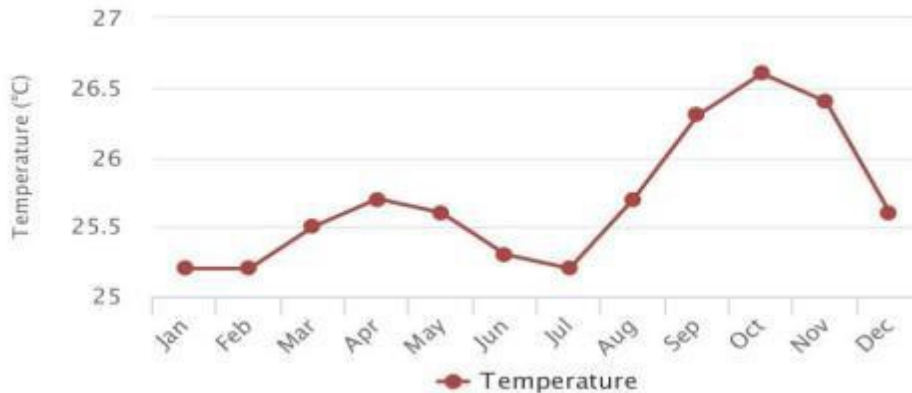
Baseline Conditions

Guyana is located within the Equatorial Trough (ET) Zone that presents wet tropical weather and a climate influenced by seasonal shifts of this trough and its associated Zone of Rainbands known as Inter-Tropical Convergence Zone (ITCZ) (SNC, 2012).

The Sophia Program area is part of the urban footprint of Region 4 (Demerara-Mahaica). The climate of Region 4 is tropical, hot and humid along the coast and the climate is moderated by north east trade winds. There are two rainy seasons (April-July and November-January) and two dry seasons (February-April and July-November) in both regions (PRD-CDC, 2016).

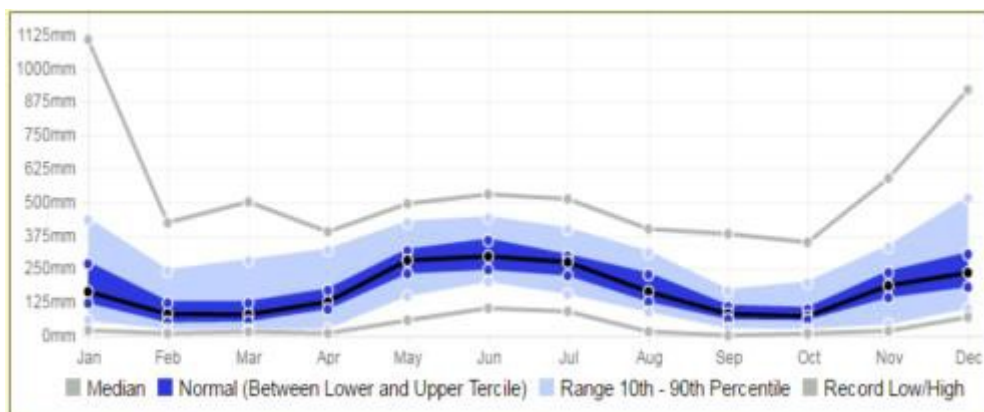
Region 4 presents an average monthly temperature of approximately 26.6 °C (World Bank, 2017). Figure 4-6 shows the average monthly temperature for the region indicating that there is a small variation in air temperature throughout the year. The coldest month of the year is January, while October is the warmest. Figure 4-7 shows historical average, maximum and minimum rainfall registered at the Georgetown climatological station operated by Hydro-meteorological Service for the 1971-2017 period.

Figure 4-6: *Average monthly temperature and rainfall for Guyana at location (6.79°,-58.14°) for Region 4 based on records for 1901-2015 period.*



Source: World Bank, 2017

Figure 4-7: Seasonal Precipitation Variation for Georgetown based on records for 1971-2017 period



Source: Hydro-meteorological Service, 2017

There are currently no ambient air quality monitoring stations in Guyana to establish baseline levels of pollutants. According to the EPA, monitoring only occurs at specific “problem areas” on a case by case basis according to public complaints; these are typically areas around rice mills, spray painting facilities and similar (EPA, 2017)..

Impact Assessment

Construction phase

During construction, the main source of Project emissions will be generation of dust from vehicle traffic on unpaved roads, as well as ground disturbing activities such as land clearing, leveling and excavation. The Project will also generate some fossil fuel combustion emissions from stationary and mobile equipment and vehicles. However fossil fuel emissions from the Project will be temporary and are not expected to be significant compared with baseline levels of transportation-related vehicle emissions in the vicinity.

Operations phase

During operations, air quality in the area could be degraded over the longer term since the infrastructure improvements are likely to encourage further development and occupation of the housing schemes, leading to additional traffic in and around the community.

Conclusion and Recommendations

The most discernible air quality impact from the Project will likely be dust generation during the construction phase, particularly if clearing, leveling and excavation activities occur during the dry seasons. While impacts from fossil fuel combustion during construction and operations will be less pronounced, it is recommended that measures be implemented to minimize and mitigate these impacts. ERM recommends the following measures:

- í Use water trucks for dust suppression as needed during clearing, excavation and transportation activities;
- í Ensure proper maintenance of construction equipment and vehicles; and
- í Ensure establishment of a grievance mechanism to provide a means mechanism for community members to voice any concerns related to dust and other Project-related air emissions.

4.4 **ENVIRONMENTAL IMPACT – SURFACE AND GROUNDWATER QUALITY AND QUANTITY**

Baseline Conditions

Surface Water

Guyana has a network of rivers and streams with many rapids and waterfalls. Surface water makes up about 10 percent of the country’s drinking water, and about 60 percent of Georgetown’s drinking water. In a number of communities on the east and west banks the GWI is in the process of increasing water system capacity to include more surface water sources, since there are now challenges with groundwater availability in the area (GWI, 2017).

There is currently no program to monitor surface water quality in the Demerara River or in the drainage canals. However, it is believed that water quality is poor since household greywaters, including septic tank effluents, discharge into the drainage canals.

Groundwater

The GWI monitors static and dynamic groundwater levels on a monthly basis, but does not currently monitor water quality. Groundwater level monitoring shows steady declines in static levels over the last decade, suggesting that groundwater is being exploited at an unsustainable rate. The corporation recently started a program to monitor saline intrusion, which is considered to be a risk but which has not occurred yet due to the clayey soils and high water pressure in Guyana’s coastal zone (GWI, 2017).

Generally the water provided to households by GWI, even when treated, is not used by the population for drinking. It is used for other household uses such as washing and cooking, while bottled water or harvested rainwater are more often used for drinking.

Impact Assessment

Surface Water Quality and Quantity

Construction phase

During construction, spills or leaks of hazardous substances such as fuels could compromise local surface water quality; however any such spills would be small, localized and promptly managed according to the Project’s Spill Prevention,

Control and Countermeasures (SPCC) Plan. Excavation activities could also cause contamination of surface waters if contaminated soils (including near septic tanks and pit latrines) are disturbed.

Operations phase

During operations, surface water quality could be affected since an increase in cleared and/or paved areas associated with additional infrastructure and housing development will increase the amount of storm water run-off into drainage canals, which could result in erosion and increased sediment load to the drainage canals. In addition, increases in local population as a result of the Project would add to the burden of greywater discharges to the drainage canals and ultimately the Demerara River, and could also result in increased solid waste being improperly disposed in the canals, which is already a problem for optimal functioning of the drainage system.

Groundwater Quality and Quantity

Construction phase

During construction, contamination of groundwater from spills of hazardous materials (e.g. fuels) is possible but unlikely since any such spill would be small, localized and quickly mitigated.

Operations phase

Increased population in the housing schemes along Guyana's coast will increase water demands. If groundwater is relied upon to meet these demands, increased pumping could result in both a decrease in groundwater levels, and in saline intrusion into groundwater.

The reduction in permeable surface associated with the paving of roads, sidewalks, and new housing lots will reduce groundwater recharge levels which could affect overall groundwater levels in the area.

Conclusion and Recommendations

Potential impacts during the construction phase are associated with unplanned events such as spills, or excavation of contaminated soils; as such these should be avoidable or appropriately managed/mitigated if proper management plans are in place.

Potential impacts during operations are associated primarily with the increase in population that would likely result from consolidation and improvement of housing scheme infrastructure, as well as the increase in impermeable surface area. ERM recommends the following measures to mitigate impacts to surface water and ground water:

- í Establish and implement a SPCC plan for the Project;
- í Ensure appropriate surveying and planning in areas requiring excavation to avoid or properly manage any areas of contaminated soils;

- í Work with the GWI to ensure further upgrade of the drainage system as needed to accommodate predicted future population growth;
- í Work with the GWI to determine the potential for establishment of a sewage system in Sophia;
- í Work with the local NDC to explore the potential of a community-wide solid waste disposal service;
- í Consider implementing a public awareness campaign in the community to advise of the effects of littering and dumping on drainage systems and flooding, and effects of improper latrine/septic tank installation on local public health; and.
- í Encourage continued/further harvesting of rainwater in the community;
- í Consider addition of infrastructure to divert stormwater runoff from paved areas to lower-lying permeable areas.

4.5

ENVIRONMENTAL IMPACT - NATURAL DISASTER RISK

Historical Floods and Other Natural Disasters

According to the CDC and IDB (2013), Guyana is vulnerable to natural disasters due to:

- í Lack of development regulation and enforcement of regulation;
- í Limited land management;
- í Increased population concentration in flood hazard areas;
- í Environmental degradation;
- í Unprepared populations and institutions;
- í Inappropriate use of resources.

These factors increase the vulnerability and number of disasters, reduce resilience, and make development unsustainable. The most populated areas of Guyana (Region 4 and Region 8) represent the highest risks for flooding due to their location below sea level.

Even though Guyana is located outside of the hurricane belt, the country has experienced occasional storms and high winds. According to the Second National Communication to the United Nations Framework Convention on Climate Change (SNC, 2012), Guyana experiences frequent floods in the coastal plain and rivers. Floods at the Project site occur when sea level rises during spring tide and during tropical storms by impacting low-lying riverine development and infrastructure. Also, flooding is caused by rainfall-induced accumulation of water due to the country's outdated and insufficient drainage systems. Human factors such as inefficient management of solid waste, lack of regular maintenance of existing drainage and irrigation infrastructure, and inadequate maintenance of sea defenses add to these risks.

Guyana is on the list of the ten vulnerable countries with low-lying coastal plains that are threatened by Sea Level Rise (SLR) in this century (Dasgupta et al., 2009). Table 4-1 shows a summary of the type of natural disasters and population affected between 1971 and 2015 in Guyana.

In 2005 Guyana's coastal zone was impacted by a 100-year flood event that had severe impacts in several regions. Other hazards are human and natural fires that occur seasonally within the region; drought; coastal erosion; and salt water intrusion. Tsunamis have also been added to the priority list of hazards based on the potential for devastating impact on the coastal region. The January 2005 flood resulted in damages to approximately 70,000 dwellings, or 44% of the national housing stock. Regions 3, 4, and 5 were the most severely affected by the floods with approximately 119,337 or 64% of the national households (ECLAC, 2005). Region 4 where Sophia is located, reported 56,312 affected households (ECLAC estimated on the basis of Ministry of Housing and Bureau of Statistics Data).

Table 4-1: Types of Natural Disaster and Population Affected Guyana from 1971 to 2015

Date	Natural Disaster	Affected Areas
July 1971	Flood	East coast, Cane Grove
1988	Drought	Not recorded
January 1989	Flood	Not recorded
June 1996	Flood	Mahaica, Mahaicony, Abary
1998	Drought	Rupununi Region
January-February 2005	Flood	G\$93 billion in damages. Flood levels reaching over one and a half meters in some coastal villages. Areas remained inundated for up to three weeks. Wells were affected in Georgetown included: Sophia (Well No. 2); Turkeyen (Wells No. 1 and 2); and Agricola Well. Essequibo Islands/west Demerara. Region No. 3, Demerara Mahaica; Region No. 4, Mahaica Berbice; Region No. 5, provinces
January-February 2006	Food	Region No. 1, Barima Waini; Region No. 2, Pomeroon/supenaam; Essequibo Islands/west Demerara; Region No. 3, Mahaica Berbice; Region No. 5, East Berbice/corentyne; Region No. 6, provinces.
December 2008	River Flood	Pomeroon, Charity areas (Moruka/pomeroon district, Pomeroon/supenaam (Region No. 2) province); Essequibo Islands/west Demerara (Region No. 3), Demerara Mahaica (Region No. 4); Mahaica Berbice (Region No. 5); East Berbice/corentyne (Region No. 6) provinces.
January to June 2010	Drought	Region No. 1, Barima Waini; Region No. 7, Cuyuni/mazaruni; Region No. 2, Pomeroon/supenaam; Region No. 8, Potaro/siparuni; Region No. 9, Upper Takutu/upper Essequibo provinces.
June 2015	Coastal Flood	Region No. 1, Barima Waini; Region No. 4, Demerara Mahaica; Region No. 3, Essequibo Islands/west Demerara; Region No. 5, Mahaica Berbice; Region No. 2, Pomeroon/supenaam provinces.

Source: Adapted from EM-DAT, 2010

The proposed development is located within the urban area of Region 4 which presents a network of drainage canals originally constructed by the Dutch during the colonial period. At this time, these canals serve for drainage to mitigate flood impacts, and irrigation to support agricultural production across Guyana's low-lying territories, including Region 4. After the 2005 flood that affected Georgetown, the Government of Guyana invested in the rehabilitation of sluices and canals and installation of new infrastructure such as the Hope-Dochfour Canal (see **Error! Reference source not found.**).

Figure 4-8: Schematic map of coastal area of Guyana's Region 4



Source: World Bank, 2014

SLR means that there is increased likelihood of tides higher than the designed level of the sea defenses. These tides exceed the freeboard of these sea defense structures and overtop them causing flooding or in more severe cases, the increased wave intensity punctures the structures causing breaches. There have been several instances of both occurring in Region 3, associated with elevated spring tides. Another factors contributing to floods are the soils characterized by clay soils that can become waterlogged after prolonged rainfall, resulting in increased over land flow. This combined with the empoldered nature of many areas (particularly the agricultural areas) increases the susceptibility to flooding (PRD-CDC, 2016).

Flood events occur when prolonged and/or intense rainfall events occur in conjunction with high tides. Due to the reliance on sluices/kokers to release excess water into surrounding waterbodies, these releases must be timed to coincide with periods of low tides. As the land is at or below mean sea level, these structures cannot be opened during high tides or they will facilitate an inflow of water from the ocean or rivers onto the land. As such, if there is a high tide and heavy or prolonged precipitation, there is a build-up of water in the canals which, once capacity is reached, overflows onto the surrounding

landscape causing flooding. These floods in general, gradually recede once low tide occurs and the sluice gates can be opened, releasing the excess water (primarily) into the Atlantic Ocean and Essequibo and Demerara Rivers.

The United Nations International Strategy for Disaster Reduction (UNISDR) indicates that over the last century the most common natural disasters to affect people in Guyana are droughts and floods (UNISDR, 2014; EM-DAT, 2010) (see Table 4-2).

Guyana's topography and population distribution causes its population to be vulnerable to floods. Guyana's coastline is low and flat, and most of the country's population and infrastructure (including the capital city of Georgetown) are located along the coast. Uncontrolled breaches of sea defenses due to unanticipated high tides and deterioration of the sea defense system adversely affect transportation, safety, and agricultural production.

Table 4-2: Natural Disasters in Guyana from 1900-2017

Type of Disaster	Year	People affected
Drought	1997	607,200
Flood	2005	274,774
Flood	2015	199,000
Flood	2008	100,000
Flood	1996	38,000
Flood	2006	35,000
Flood	1971	21,000

Source: Adapted from EM-DAT, 2010

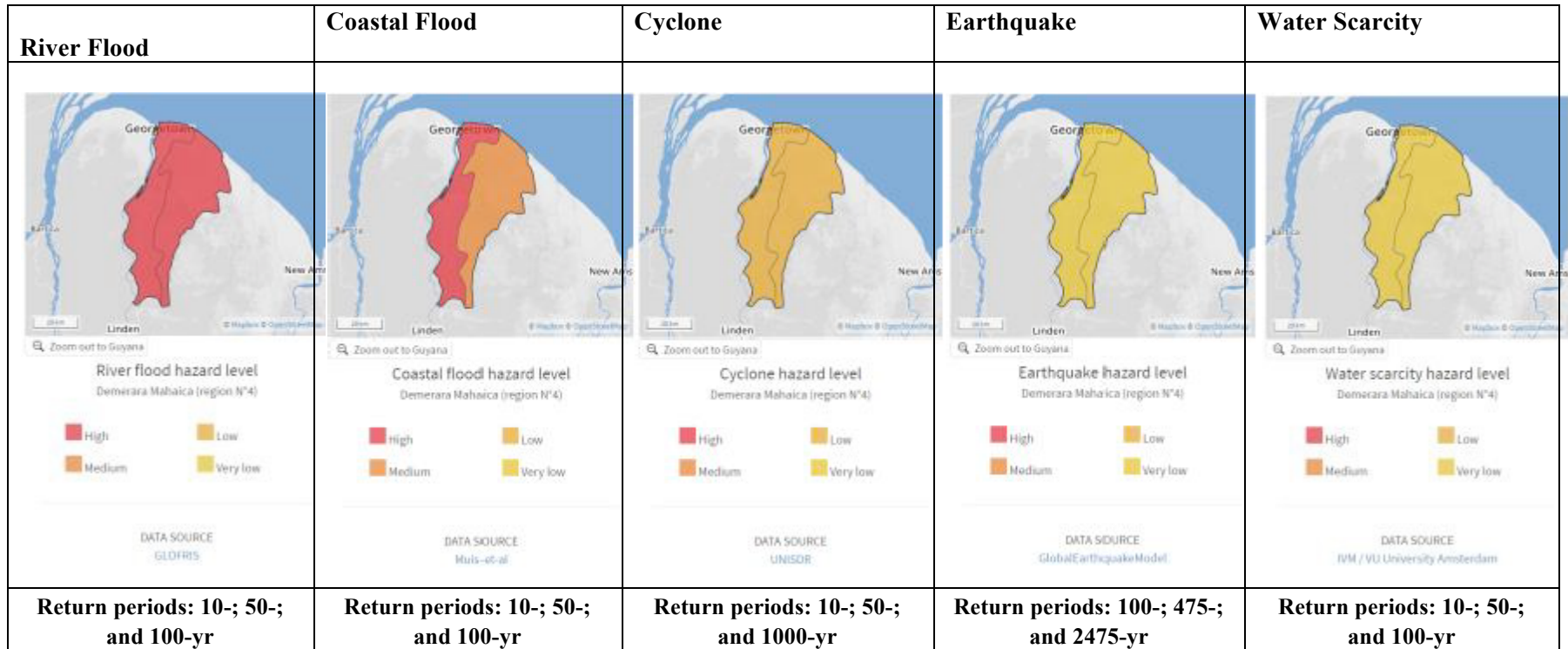
The proposed settlement is located within Region 4 which is prone to river and coastal flooding. Table 4-3 presents a summary of main natural hazards affecting the region while Figure 4-9 shows the areas and hazard levels for the region. Strong wind is another hazard affecting the region, but with less intensity and frequency.

Table 4-3: Main Natural Hazards in Guyana

Hazard	Level of Hazard in Region 4	Level of Hazard in Region 3
River flood	High	High
Coastal flood	High	High
Earthquake	Very low	Very low
Cyclone	Low	Low
Water scarcity	Very low	Very low

Source: <http://thinkhazard.org/report/107-guyana>

Figure 4-9: Hazard maps in Guyana's Region 4



Source: <http://thinkhazard.org/report/107-guyana>

Drought

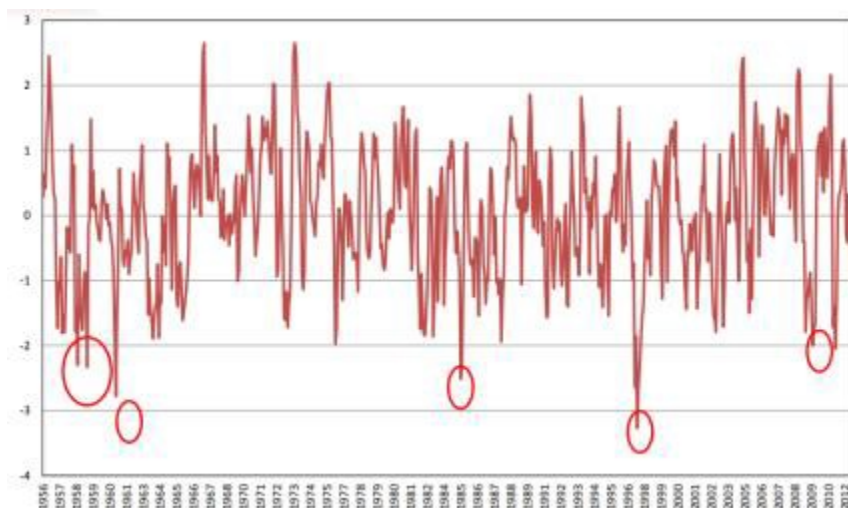
This hazard occurs when there is insufficient moisture caused by a lack of precipitation over an extended period of time. The major drought events in Guyana have been associated with the El Niño Southern Oscillation (ENSO) which in most cases results in a deficit in precipitation in Guyana. For instance, during the 1997/1998 ENSO event, precipitation was approximately 50%-85% below normal across Guyana and a state of emergency was declared in March 1998 because this meteorological drought resulted in severe water stress that affected 80% of the population and had adverse effects on the economy (PRD-CDC, 2016). The main sectors impacted by drought are agriculture (losses of approximately USD\$22 million in rice production and USD\$7 million in sugar) and its sub-sectors such as livestock and fisheries.

Drinking water shortages also occurred in Georgetown during the 1997/1998 drought event. Water courses and ponds reduced their volume of freshwater and in some cases dried up completely. This reduction of freshwater resulted in intrusion of salt water to surface and ground freshwater sources such as coastal wells (Seulall, 2017). A drought event in May 2009-Feb 2010 also caused concerns in the agricultural community while the September 2012 - January 2013 drought also affected some agricultural areas in Guyana. Other sectors that have been affected by droughts in Guyana are mining and forestry (Seulall, 2017).

The Guyanese Water and Sewerage Act includes a policy and directives for drought (Part 1V). This policy specifies that the Hydrometeorological Service has the mandate to advise policy makers of any drought that has occurred or which is likely to occur. The drought order can last for a period of up to three months. This period starts with the day on which the order is enforced, unless it is extended by the Minister of Agriculture who has the power to issue a drought order in Guyana.

Since January 2013, the Caribbean Institute for Meteorology and Hydrology (CIMH) has computed the Standardized Precipitation Index (SPI) for Guyana Coast. Ten climatological stations have been used to estimate the SPI for Guyana Coast including Georgetown Botanical Gardens Station located within the Project's area. The SPI is widely used to characterize meteorological drought on a range of timescales; however the SPI is not a drought prediction tool (NCAR and UCAR, 2017). Figure 4-10 shows the preliminary SPI results calculated by CIMH. These results indicate moderately and severely dry conditions for Georgetown by using precipitation data for the 1956-2012 period.

Figure 4-10: *Three month SPI (1956-2012) calculated for the Georgetown Botanical Gardens Station*



Source: Seullal, 2017

Climate Change Projections

Anthropogenic activities are the primary sources of greenhouse gas (GHG) emissions contributing to the warming of the Earth’s atmosphere and leading to climate change and sea level rise (SLR). GHG and climate variability have manifested themselves in SLR, more frequent and extreme weather events, ocean acidification, coral bleaching, coastal erosion, and changing precipitation patterns and have the potential to impact negatively on both ecological and socioeconomic factors. Small and developing countries with long coastlines, low-lying coasts and whose populations live in the narrow coastal belt are expected to be the most vulnerable to climate change effects. The main climate-change related threats to Guyana include the increase of heavy precipitation producing floods; sea-level rise and storm surges mainly at the coastal zones; increase in temperature combined with reduction of main annual precipitation deriving from drought episodes (SNC, 2012).

According to CDC and IDB (2013), global climate change is the most serious threat to sustainable development facing the Caribbean Community (CARICOM) states. The projected impacts associated to global climate change on the Caribbean Region are expected to be devastating due to the limited adaptive capacity of the CARICOM small-island and low-lying coastal states such Guyana. Global climate change is expected to result in more hostile regional climate change and rising sea levels. Rising sea levels, together with the associated coastal erosion and salt water intrusion, and escalation in the frequency and intensity of tropical storms and hurricanes, and disruptions in rainfall and fresh-water supply threaten the very existence of the CARICOMOM states.

Climate change projections for Guyana are included in the Second National Communication to the United Nations Framework Convention on Climate Change (SNC, 2012). Table 4-4 shows the climate change projections for Guyana generated from two GCM DGCM2 and HadCM3 based on the use of different Special Report on Emissions Scenarios (SRES) B1, A1B and A2. The Intergovernmental Panel on Climate Change (IPCC) has replaced these SRES with new scenarios called Representative Concentration Pathways (RCP) and RCP 8.5 is nearly identical to A2.

- **RCP 8.5:** high emissions with a future with no policy changes to reduce emissions. The RCP 8.5 is comparable with SRES A2 and A1F1;
- **RCP 6.0:** intermediate emissions consistent with the application of a range of technologies and strategies for reducing GHG emissions. The RCP 6.0 lies between the SRES B1 and A1B;
- **RCP 4.5:** intermediate emissions consistent with a future with relatively ambitious emissions reductions. This RCP is comparable with SRES B1; and
- **RCP 2.6:** low emissions. The RCP 2.6 scenario is much lower than any SRES scenario because it includes the option of using policies to achieve net negative CO2 emissions before end of 2100.

Guyana is highly vulnerable to sea level rise (SLR) associated to climate change, in addition to the height of the sea. Approximately 80% of Guyana’s population lives in the low-lying coastal region and some populated sections are already below sea level from 0.5 m to 1.0 meter (UOCS, 2011). Guyana could be affected by SLR increasing flooding in coastal areas, and by the reduction of precipitation causing more frequent and severe droughts.

Table 4-4: *Climate Change Projections for Guyana according to the HadCM3 and CGCM2 models*

Parameters	Value	Year	Source
Air Temperature overall annual mean	+2 °C to 4 °C	2100	SNC, 2012
Precipitation mean annual	-34% to +20%	2090	SNC, 2012
Sea Level Rise (SLR)	0.14 m to 5.94 m 0.21 m to 6.02 m 0.25 m to 6.19 m	2031 2051 2071	SNC, 2012

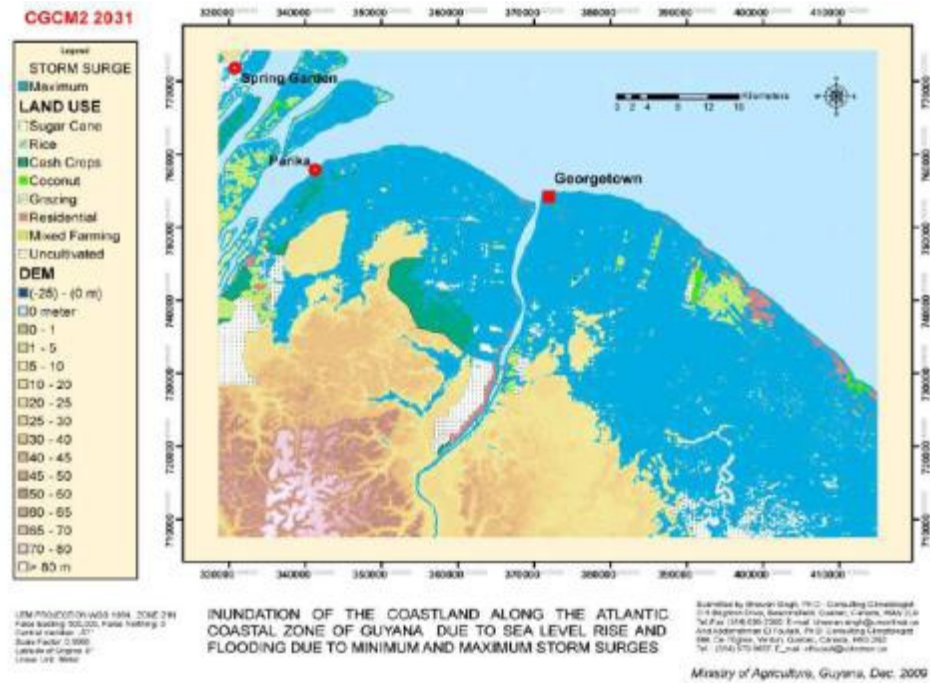
The SNC (2012) reports projections of land inundation during minimum and maximum storm surge from Global Climate Models (GCM) CGCM2 and HadCM3. Table 4-5 summarizes the maximum estimated coastal flooded areas for the projected maximum storm surge while Figure 4-11 shows the extension of the projected flooded area, which includes the Sophia area.

Table 4-5: Projections of Coastal Flooded Areas during Maximum Storm Surge

Model	Year	Maximum Coastal Area that is likely to be flooded (km ²)
CGCM2	2031	1,402
	2051	1,410
	2071	1,425
HadCM3	2031	1,391
	2051	1,398
	2071	1,402

Source: Adapted from SNC, 2012

Figure 4-11: Projected Flooded Areas due to the Maximum Projected Storm Surge from CGCM2 by 2031



Source: Ministry of Agriculture, 2009 taken from SNC, 2012

Impact Assessment

According to UNISDR (2009), *hazard* is a dangerous phenomenon, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. On the other hand, *disaster* is defined as a serious disruption of the functioning of a community or a society involving widespread, human, material, economic or environmental losses and impacts,

which exceeds the ability of the affected community or society to cope using its own resources.

The Program itself is vulnerable to the natural disasters such floods and droughts, which could have adverse impacts during both construction and operations.

Construction phase

Tropical storms and storm surges could significantly impact construction and result in damage to Program facilities (e.g., damage to facilities and construction equipment). In addition, construction activities such as excavation can result in environmental impacts that can exacerbate the effects of natural disasters (e.g., increased erosion and sedimentation of drainage canals leading to impaired drainage system functioning, potentially causing an increase in inundated areas).

Operations phase

Natural disasters could damage housing and infrastructure, and could also pose a danger to the local population. The Program will result in increased occupancy in the Sophia housing scheme over the medium to long term, which represents a larger population that will be exposed to the area's natural hazard risk.

Risk is defined as the combination of the probability of an event and its negative consequences (UN, 2014). The components of risks for Project, people, and environment are:

- Exposure (probability and intensity of natural disasters and the number of people exposed or threatened by these disasters); and
- Vulnerability (considering susceptibility, coping capacity, and adaptive capacity).

The Institute of Spatial and Regional Planning of University of Stuttgart (2016) has prepared maps showing World Risk Index (WRI). The WRI provides an approach to assess risk and vulnerability to natural hazards at country scale allowing the comparison of countries at global scale. Based on the estimated WRI, Guyana presents a very high exposure to natural hazards. The WRI is estimated by using the following equation:

$$WRI = Exposure * (Susceptibility)(Coping Capacity)(Adaptive Capacity)$$

Exposure relates to physical exposure with regard to natural hazards (e.g., earthquakes, cyclones, floods, droughts, sea level rise). Some indicators for susceptibility are population without access to improved sanitation, population without access to an improved water source, extreme poverty, Gross Domestic Product (GDP) per capita. Indicators for coping capacity are corruption perception index, good governance, number of physicians per 10000 inhabitants, number of hospital beds per 10000 inhabitants, and insurances. Indicators for adaptive capacity are adult literacy rate, combined gross school enrolment, gender parity in education, water resources, biodiversity and habitat protection, private health expenditure, agricultural management among others.

Table 4-6: WRI for Guyana

Parameter	Value	Notes
Exposure	22.90	Very High
Exposure Rank	22	
Susceptibility	28.97	Medium
Susceptibility Rank	71	
Vulnerability	50.70	Medium
Vulnerability Rank	74	
Lack of Coping Capacity	78.83	High
Lack of Coping Capacity Rank	62	
Lack of Adaptive Capacity	44.31	Medium
Lack of Adaptive capacity Rank	87	
WRI 2015	11.61	Very High
WRI 2015 Rank	22	

Source: Adapted from University of Stuttgart, 2016

According to the WRI shown in Table 4-6 Guyana is ranked 22 of 171 countries in the world in terms of vulnerability with a WRI of 11.61 calculated for 2015 (very high). Guyana is especially vulnerable to natural hazards for several reasons:

- ❖ Concentration of population located in hazard prone areas (low-lying);
- ❖ Weak institutional capacity to prepare for and respond to natural disasters; and
- ❖ High levels of poverty that limit the ability of the population to respond to natural disasters.

The above sections have presented the baseline hydrological and meteorological conditions for the Program area based upon available information and records. This has demonstrated vulnerability and risk due to natural hazards. Relevant climate change projections also illustrate a dynamic system with anticipated changes which could pose changes in the hazard and risk profiles.

These natural hazards (flooding and droughts) may pose risks to the investments made by the Bank, to the surrounding population and to the environment. Other natural risks may occur at the regional level but these are not described in this study.

Potential Adaptation Measures

Flooding represents the main adaptation challenge for the Program and for Guyana because Region 4, and the City of Georgetown, lie below mean high tide level. Given the Project's infrastructure and people would be at risk of coastal and inland flooding, implementation of adaptation measures is strongly

recommended. Some adaptation measures that can be implemented are listed below under Conclusions and Recommendations.

Conclusion and Recommendations

The Program area is already prone to the natural risks described, and with appropriate management the Program is not anticipated to worsen or intensify these natural risks. The Program might however introduce more residents into these areas of high risk, as well as bring new infrastructure and construction to the area, thereby increasing the exposure profile. These negative impacts could be minimized, however, by the implementation of mitigation and adaptation measures developed in consultation with the relevant government and non-governmental stakeholders. Furthermore, residual impacts could be offset by implementing management measures that result in positive impacts such as preventing floods and riverine erosion. It is therefore ERM's opinion that the Program could have a net positive impact on the area with respect to natural hazards.

The key to achieving a net positive impact will be the careful selection, combination and implementation of a series of adaptation measures that protect vulnerable areas, are cost-effective in their implementation, build resilience and effectively address the identified hazard, rather than just relocate it. For instance, flood protection should not create worse flooding downstream of the protected area. The following measures, some of which are outside the scope of the Program activities but which should be considered in collaboration with other relevant Ministries and government entities to ensure the long-term viability of the Program, are recommended:

- ❖ Enforcement of adequate building codes and adequate land use regulations;
- ❖ Reinforcement of sea and river defenses by considering SLR projections in vulnerable areas;
- ❖ Implementation of building set-back legislation and/or minimum residential housing living area elevation standards to limit buildings and other major developments on high risk and vulnerable to climate change zones;
- ❖ Provision of adequate and regular maintenance to the existing drainage system. The Guyanese drainage system is mostly natural (e.g., a gravity based system improved by pumps) and depends on the main river, which extend beyond the coast (SNC, 2012);
- ❖ Installation of mechanical pumping stations to aid drainage of water during high tide and precipitation events. These pumps will help flowing out excess water in the drainage canals;
- ❖ Continued promotion of rain harvesting activities in the new housing developments; and
- ❖ Consider addition of infrastructure to divert storm water run-off to lower-lying, permeable areas to encourage more groundwater recharge.

OTHER POTENTIAL RISKS AND IMPACTS

In addition to the risks described in aforementioned sections, other potential environmental and social impacts that may arise from Program-related activities are described below.

Noise

Construction area noise and vibration is dominated by heavy equipment use. Noise generated by the Program may represent a nuisance impact for receptors (people) near the active areas.

Noise impacts are likely to be unavoidable, but can be minimized by limiting the hours of construction (e.g., not working near any noise-sensitive receptors at night) and limiting construction vehicle idling (which, as noted above, will also reduce air emissions). Implementation of these measures, especially avoiding any construction at night (e.g., 10 p.m. to 6 a.m.), should minimize noise impacts on people. These measures should be part of the environmental management framework to be adhered to by construction contractors as part of their contract requirements.

Community Health, Safety and Security

Program construction will require the presence of construction workers in Sophia. However at this time, it is not expected that the influx of such workers would pose a risk to community health and safety. Local construction companies will implement the Projects, and it is expected that the large majority of workers will be Guyanese nationals originating from the greater Georgetown area. As such, concerns regarding community disruption or introduction of communicable diseases by a foreign workforce are not expected to be an issue. Furthermore, it is expected that workers would commute daily to the work sites and would not be accommodated in Sophia. The biggest potential risk associated with the construction workforce is likely to be the increase in traffic safety risks for current road users; it is recommended that this risk be managed via a Traffic Management Plan that would outline safety requirements for all workers, and establish a plan for worker commuting and parking that would minimize risks for the Affected Community.

Biodiversity

ERM has not performed an assessment of potential biodiversity impacts given the current urban focus of the Program. If however the evolving plans involve the potential for biodiversity impacts, such as the felling of trees or dredging/construction within Region 4, appropriate levels of assessment will be required to be undertaken.

5.0 *ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK*

5.1 *ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM*

The Program will develop an Environmental and Social Management System (ESMS) to supplement the Program's other management plans. This system will identify potential impacts of the Program and, in turn, describe steps for the mitigation, management, monitoring and assessment measures (**Error! Reference source not found.**) for the potential impacts identified in Chapter 4.

Table 5-1: Proposed ESHS management measures and monitoring programs

Topic	Potential Impact	Phase	Mitigation and management measures	Execution responsibility	Verification (as necessary)	Monitoring and Reporting
Climate	Air Quality	Construction	Ensure construction vehicles and equipment are properly maintained. Limit idling for construction vehicles. Use water spray trucks for dust suppression.	Construction Contractor	Site Inspection by a third party	Daily inspection reports and corrective action directives
Soils	Erosion	Construction	Schedule construction activities to avoid periods of heavy rainfall; contour and minimize length and steepness of slopes; employ silt fencing as necessary.	Construction Contractor	Site Inspection by a third party	Daily inspection reports and corrective action directives
Noise	Noise, vibration	Construction	Limit idling of construction vehicles and equipment. Limit construction activities to daylight hours.	Construction Contractor	Site Inspection by a third party	Daily inspection reports and corrective action directives
Livelihoods	Economic displacement	Construction/ Operation	When details of the Program interventions in Sophia become available, develop a Livelihood Restoration Plan (LRP) identifying all potentially affected individuals and businesses, and establishing measures for avoidance, compensation, and/or restoration activities as required. Incorporate requirements for local employment in construction and maintenance contracts.	Borrower/ Executing Agency	Inspection/assessment by a third party	Monitoring of LRP indicators by third party
Transportation	Traffic Circulation, parking	Construction/ Operation	Develop a Traffic Management Plan for the Program Area. The plan may include methods for notification due to road closure, scheduling of deliveries to avoid peak traffic hours, identification of preferred transport routes, and measures to limit congestion and parking.	Construction Contractor/ Ministry of Transport		Monthly inspection and corrective action directives

Drainage	Increased effluent loads, increased blockage of canals	Construction/ Operation	Consider implementation of a drainage canal maintenance program as part of the Program intervention to maintain maximum capacity of canals. Consider implementation of a community-wide solid waste management program to reduce the amount of waste in drainage canals. Ensure proper management of Program-generated wastes. Reduce Program-related risk of erosion and sedimentation that could compromise drainage canal integrity.	Borrower/ Ministry of Public Infrastructure/ Neighborhood Democratic Councils/ Construction Contractor/		Daily inspection and corrective action directives
Public Spaces and Facilities	Restricted access	Construction/ Operation	Implement an access management plan that maintains spaces for critical community facilities for pedestrians and vehicles through careful sequencing of construction activities.	Construction Contractor		Monthly inspection reports and corrective action directives
Utilities	Interrupted service	Construction	Provide advance notification of any planned interruptions to water and power service as a part of construction activities. If interruptions are of more than momentary duration, provide alternative water and power sources.	Construction Contractor		Daily inspection reports and corrective action directives
Waste	Waste Generation	Construction	Develop and implement a Waste Management Plan that outlines appropriate handling, storage and disposal protocols for solid, hazardous and human wastes.	Construction Contractor	Site Inspection by a third party	Daily inspection reports and corrective action directives
Hazardous Materials	Environmental Contamination	Construction	Provide adequate secondary containment for fuel storage tanks. Use impervious surfaces for refueling areas and other fluid transfer areas. Provide portable spill containment and cleanup equipment on site. Prepare plans and procedures to respond to the discovery of contaminated media to minimize or reduce risks to health, safety and the environment.	Construction Contractor	Site Inspection by a third party	Daily inspection reports and corrective action directives

The Disaster Risk Management and Adaptation Plan (DRMAP) recommends measures to prevent and/or mitigate the identified impacts and risks (see section 4.3), and provides guidance relative to emergency preparedness and response.

Management Measures

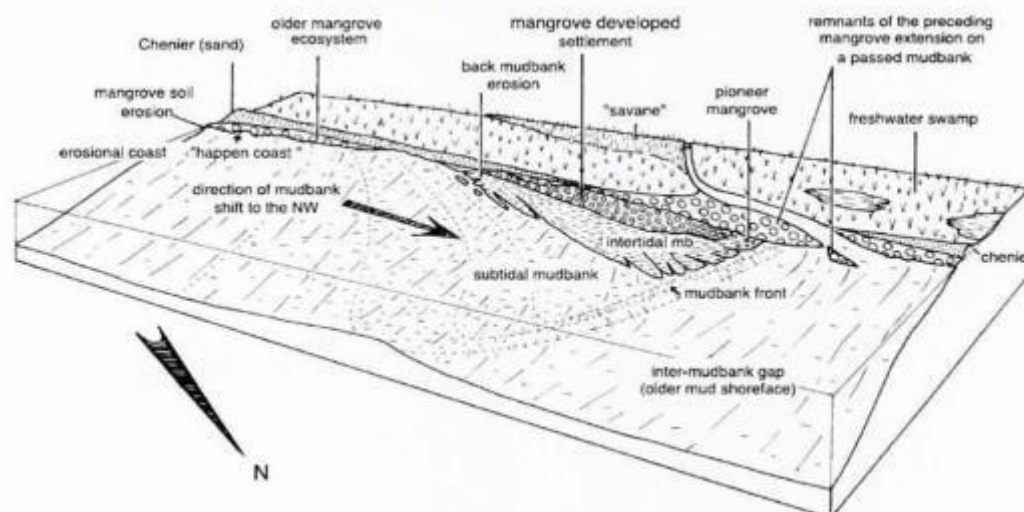
This section discusses measures that could be implemented to help reduce the Program risk to natural disasters. Since the Project design is still at conceptual level and management plan is not complete, we expect these measures to be incorporated into the design, construction and final management plans for the Project. This section is not a substitute for actual designs, construction management and operational management, but serves as a guide for those Project's elements.

Guyana's coastal plain is situated at one-meter below sea-level to sea-level, which renders the coastal plain highly vulnerable to erosion and salinization especially during spring tides (GMRP, 2010). Approximately 90 percent of the population, infrastructure, and economic activities are concentrated in the coastal plain, so protection from sea level rise and coastal flooding is a national priority. As a result, Guyana's national government has established a network of coastal protection measures that consist of a combination of hardscapes and natural buffers. This network is known collectively in Guyana as the "sea defenses."

Hardscaped defenses generally consist of an earthen embankment protected on the seaward side by a concrete slab and/or a (coping) wave wall or by rock armoring (rip-rap) (Institutional Capacity Building Activities on Guyana Sea Defenses, 2005). Most of the existing hard structures are between 30 and 70 years old, and many are in need of repair (Institutional Capacity Building Activities on Guyana Sea Defenses, 2005).

The natural sea defenses are a combination of mud banks and mangrove forests along the Guyana coastline. The mud banks are comprised of fine sediments that originate from the Amazon, and are carried by the North Brazil Current along the northern coast of South America. Waves from the Atlantic Ocean (swell) break on the mud banks, protecting part of the coastline from wave attack (Institutional Capacity Building Activities on Guyana Sea Defenses, 2005). The mud banks also promote further sediment accretion and mangrove growth, thereby enhancing the resilience of the natural sea defense network.

Figure 5-1: Typical Distribution of Mudbanks and Mangroves on Guyana's Coast



Source: *Institutional Capacity Building Activities on Guyana Sea Defenses, 2005.*

Mangrove forests along coastal Guyana also contribute to sea defense by damping wave action and protecting the coastal bank from shoreline erosion. The 2010 National Mangrove Management Action Plan identifies mangroves as the most effective protection from coastal flooding in Guyana. Many governmental and non-profit groups, such as the Government of Guyana through the Ministry of Agriculture and the Guyana Mangrove Restoration Project (GMRP) have been working together to restore mangroves along the Guyanese coast. GMRP has been operating since May 2010, with mangrove planting and protection initiatives at ten locations along the Guyanese coast (GMRP, 2010). An important aspect of the GMRP is promotion of the sustainable management of Guyana's mangrove forests (Roopsind, 2012). Eight of the ten mangrove restoration areas are located adjacent to Georgetown, while two are located near New Amsterdam, Guyana.

Some potential measures to prevent, adapt or mitigate the risks associated with natural disasters are discussed below and listed in Table 5-2.

- Coordinate monitoring of salinity concentrations and flows at Demerara River with the Environmental Protection Agency Guyana (EPA);
- Implement an efficient municipal solid waste management program that includes the collection of solid wastes from all the proposed developments. Georgetown has a solid waste collection system serving approximately 92% of the city's residential population (SNC, 2012). However, the drainage canal system is sometimes used for dumping of solid waste;
- Continued monitoring of sea levels and river water levels;
- Create and/or reinforce capacity building on urban flood-risk management including the dissemination of hazard maps, evacuation actions and routes, and community post-disaster recovery strategies;

- Implement a preventive maintenance program for the existing drainage canal system. This program would allow maintenance of the existing drainage system at its maximum capacity, thereby reducing the risk for flooding.
- Design and construct infrastructure with the capacity to occasionally endure water excess from periodic flood events. For instance, levees, floodwalls (permanent or deployable) or tidal barriers considering total surge (storm surge, waves and SLR). These structures must be designed to sustain at least a 1% annual change water elevation event;
- Reinforce existing and new flood control infrastructure with green infrastructure measures. For instance, reinforcement of the existing riprap streambank protection located along the banks of the Demerara River should be considered using options such as vegetation and woody material for bank stabilization; pole plantings (or live stakes) and coir rolls;
- Evaluate the alternative of using adaptation measures such as dry and/or wet flood proofing. These adaptations are aimed to inhibit the infiltration of water by designing the exterior of a building with waterproof coatings, impermeable membranes, aquarium glass, flood vents or additional layer of exterior concrete or masonry. These flood proofing measures are best suited for commercial, mixed use, or community facility buildings;
- Use appropriate building codes for new buildings that will be built or renewed as part of the Program area;
- Implement stormwater management activities for the Program. These activities must be synchronized with urban development and existing stormwater management plans for Region 4;
- Conduct regular inspections and provide routine maintenance of all existing river and sea defenses;
- Consider strategies for protecting building systems such as mechanical, electrical, fuel, HVAC systems, plumbing, elevator, and fire protection systems which are highly vulnerable to flood waters. Strategies for protecting these systems are usually aimed to relocate vulnerable equipment or conduits, secure specific components, or adapt their functioning to minimize damage. Example of these systems include relocating or sealing external utilities, anchoring, elevating, or constructing a flood proof enclosure around equipment, elevating mechanical equipment and electrical wiring, among others;
- Examine and verify that the proposed measures do not present implications for drainage and impacts on adjacent sites.

Implementation of these measures should adequately manage the overall risk to the Program from main natural disasters at the Program sites. In addition to these measures, there are a variety of other pathways to increasing riverine/sea climate resilience, including preparing for extreme events through developing plans for evacuation, emergency response, and recovery, and adapting infrastructure systems to the impacts of climate change. All these combined

strategies can be part of a multi-layered approach to reducing risks. However, it should be noted that it is not possible to fully eliminate all risks due to the possibility of a storm or storm surge larger than or different from what has been planned for, as well as potential for failure of different measures.

Emergency Preparedness and Response

As part of, and in addition to, risk prevention measures, there should be preparedness and response activities in case an emergency occurs. These activities should be coordinated with the Guyana Red Cross (GRC) and the Civil Defense Commission, which lead activities included in the Emergency Response Plan for Guyana.

During construction, the Construction Contractor should develop a Construction Emergency Response Plan that describes procedures to be implemented in forecasted or unanticipated events. This would involve securing equipment and materials, stabilizing disturbed areas, and similar actions.

Table 5-2: Disaster Risk Management Framework

Event	Specific cause	Effect	Plan	Prepare	Response	Recovery	Responsible Parties	Monitoring
Storms	Excessive precipitation	High water levels and overland flow exposes or damages	Design protective structures that consider high flow events and add climate change factor. Combine Green infrastructure with existing and/or new flood protection structures. Perform a localized drainage study and survey for the catchment and network serving the Program area.	Complete regular integrity and condition inspections. Designate and retain an on-call engineering inspector Obtain on-call repair services contract	Isolate affected segment. Contact engineer for assessment Evaluate damages on homes and businesses Coordinate response activities with GRC and CDC.	Complete repairs Identify and implement activities that will reduce or eliminate risk of repeat failure Test repaired systems Conduct an assessment of the causes and effects of the flood to make recommendations that would improve preparedness for the next event and reduce losses associated with future flood events.	Plan: Project engineer Prepare: Engineering inspector from appropriate ministry or government agency, e.g. Ministry of Public Infrastructure Response: CH&PA in coordination with GRC and CDC Recovery: CH&PA in coordination with CDC and relevant ministries and agencies (e.g. Public Infrastructure, GWI)	Monitoring of infrastructure conditions and integrity on a monthly basis
	Excessive precipitation	Erosion with exposure or damage to riverbanks and/or facilities	Determine and install bank and slope protection or anchors if possible in most vulnerable areas. Combine Green infrastructure with existing and/or new erosion protection structures (e.g., riprap)	Complete regular integrity and condition inspections. Designate and retain an on-call engineering inspector Obtain on-call repair services contract Conduct erosion monitoring along the banks of the Demerara River	Isolate affected segment. Contact engineer for assessment Evaluate damages on homes and businesses Coordinate response activities with Public Works, EPA, GRC and CDC.	Complete repairs Identify and implement activities that will reduce or eliminate risk of repeat failure Test repaired systems Conduct an assessment of the causes and effects of floods/erosion to make recommendations that would improve preparedness for the next event and reduce losses associated to future flood events.	Plan: Project engineer, construction contractor Prepare: Engineering inspector from appropriate ministry or government agency, e.g. Ministry of Public Infrastructure Response: CH&PA in coordination with GRC and CDC Recovery: CH&PA in coordination with CDC and relevant ministries and agencies (e.g. Public Infrastructure, GWI)	Monitoring of infrastructure conditions and integrity on a monthly basis Erosion monitoring by relevant government ministry or agency (EPA, Ministry of Public Infrastructure, or EPA).

Event	Specific cause	Effect	Plan	Prepare	Response	Recovery	Responsible Parties	Monitoring
Increased water levels	Storm Surge and/or Sea Level Rise	High water levels and overland flow exposes or damages	Design protective structures that consider high flow events and add climate change factor. Combine Green infrastructure with existing and/or new flood protection structures. Perform a localized drainage study and survey for the catchment and network serving the Program area	Complete regular integrity and condition inspections. Designate and retain an on-call engineering inspector Obtain on-call repair services contract	Isolate affected segment. Contact engineer for assessment. Evaluate damages on homes and businesses. Coordinate response activities with GRC and CDC.	Complete repairs Identify and implement activities that will reduce or eliminate risk of repeat failure Test repaired systems. Conduct an assessment of the causes and effects of the flood to make recommendations that would improve preparedness for the next event and reduce future flood loses.	Plan: Project engineer Prepare: Engineering inspector from appropriate ministry or government agency, e.g. Ministry of Public Infrastructure Response: CH&PA in coordination with GRC and CDC Recovery: CH&PA in coordination with CDC and relevant ministries and agencies (e.g. Public Infrastructure, GWI)	Quarterly monitoring of sea and river defense infrastructure conditions

STAKEHOLDER ENGAGEMENT PLAN

Stakeholder engagement is an essential part of the ESA and project development process. It ensures that stakeholders, including Project-affected communities, are provided with timely and transparent information regarding the Project, and also allows stakeholders to provide input on potential issues of concern relating to the Project.

This stakeholder engagement plan (SEP) outlines the program of engagement for the community of Sophia, which will be included as a beneficiary community for the reformulated loan. Development, update and implementation of this SEP are the responsibility of the Central Housing and Planning Authority (CH&PA).

This SEP conforms to international good practice and has also been developed to align with the IDB's Guidelines for Meaningful Stakeholder Consultation, and the CH&PA's Approach to Enabling Positive Community Change through Community Participation.

Approach

A successful public involvement program engages stakeholders in honest, open, and meaningful dialogue early and often throughout the course of a project. Key elements to this approach include:

- Identifying all stakeholders who could have an interest in the Project.
- Identifying priority issues for community members.
- Engaging community leaders early to build understanding of the Project's purpose, need, and benefits, and provide updates as the Project progresses.
- Meeting with Project-affected communities in appropriate forums and using suitable methods to better understand local, context-specific issues and demonstrate a commitment to public involvement.
- Providing stakeholders with clear, accurate, and comprehensible information materials in advance of, and during consultation events.
- Providing adequate notice of all public meetings and other such public outreach efforts.
- Providing stakeholders with a mechanism to seek remedy if the Project causes harm to them or the environment.
- Gathering and documenting input from stakeholders, and considering this input in the ESA and overall Project development process.
- Stakeholder Identification

A database of stakeholders has been developed and will continue to be updated as additional stakeholders are identified. The list includes the following stakeholder categories:

Public Administration: Government and regulatory agencies, elected officials, and public service providers that may be at the local, state, national or international levels. Examples include Ministry of Communities, Ministry of Social Protection, Ministry of Public Infrastructure, and the local NDC.

International Organizations: Organizations operating in Guyana that may be involved in community projects and initiatives, such as the UNDP, UNICEF, PAHO.

NGOs: NGOs operating in Guyana and that may have interest in the Project area, such as Habitat for Humanity, YMCA/YWCA, and Guyana Red Cross Society.

Private Sector: Businesses of any scale that could be affected positively or negatively by the Project. Examples include commercial enterprises within and adjacent to the Project areas that could be affected positively or negatively during the construction and operations phases; and prospective suppliers of goods and services to the Project.

Media: News media outlets that may range from local to international in distribution.

Community Groups: This includes faith-based organizations, community and social groups, and service clubs such as the Rotary Club and Lions Club.

General Population of the Beneficiary Community: The community of Sophia consists of seven sections, namely Section A - Liliendaal, Section B - Pattensen, Section C - Turkeyen, Section C - Cummings Lodge, Section D - Turkeyen, Block E - Farmer's Group and Plump Park. These sections consist of 4,433 lots. There are also over 300 people living in unallocated areas, on the drainage reserves. The total population of the area is estimated at 32,000.

All stakeholders identified to date are compiled in a Stakeholder Register (Attachment A to this document). The stakeholder register will be continually updated over the course of the Project.

Informational Materials

Clear, accurate, and comprehensive informational materials for use with stakeholders during consultation events will be produced. These materials will be updated as the Project evolves and supplemented with additional materials to include:

- Project fact sheet;
- Frequently Asked Questions;
- Advertisements for public meetings; and
- Project maps.

Project Contact Vehicles

To give stakeholders easy and convenient access to the Program, the following contact vehicles will be put in place:

- Toll-free number for general Project inquiries;
- General email address; and
- Mailing address.

The contact vehicles will be monitored regularly and response protocols have been developed to ensure all inquiries are tracked for reporting purposes and that responses are provided.

Stakeholder Point of Contact

A single point of contact for stakeholder queries and concerns will be established at the CH&PA.

Stakeholder Outreach

CH&PA staff will lead the process of conducting outreach with stakeholders, including community leaders, residents of Sophia, community groups, NGOs and government representatives. The primary purpose of these meetings is to share information, answer questions and obtain stakeholders input on issues and concerns to be addressed in the ESA and in Project development, planning and implementation. These meetings will also help CH&PA to identify new stakeholders to include in future outreach activities.

Public Consultation Meetings

CH&PA has thus far held one meeting with Sophia community leaders. This was held on Friday, June 23 at 4:00 pm. A total of 26 external stakeholders attended, representing the following organizations and groups:

- Sophia Community Action Group
- Sophia Community Development Association
- Citizen Security Strengthening Programme
- Farmers Field Community Group
- North Sophia Community Group
- Pattensen Youth in Action Club
- Sophia Development Group
- Hope for the Nation Group
- Area R&L Work Group
- Cummings Park Group

- CDC Patterson South
- CDC Secretariat
- National Community Development Council
- Patterson Youth in Action Club
- Youth Civil Society Action Group
- Cummings Lodge Community Group
- Mayor and City Council of Georgetown

The primary purpose of the meeting was two-fold: to introduce the Project to community leaders, and to obtain information on the characteristics and concerns of the community in order to appropriately plan the next phases of consultation.



CH&PA and ERM meeting with Sophia community leaders, June 23 2017

Based on the feedback received from the community leaders, it was determined that a public meeting should be conducted in each of the seven fields, and that Sunday afternoon is the ideal time of week to hold such meetings. Community leaders did not identify any marginalized or disenfranchised subpopulations that they felt would not be adequately represented at community-wide meetings. As such, it should be appropriate to include subpopulations such as women, youth and elderly in these general meetings.

A series of seven community meetings is proposed over the following weeks. These should be similar in format and content, with the main objectives of presenting information about the Project and the ESA process, and obtaining feedback from the community to inform the ESA and other Project planning activities. Advertisement of the events should be in coordination with

community leaders; CH&PA should develop a brochure with basic Project information as well as the meeting details, and distribute these to community leaders for further distribution within the community. Community leaders also mentioned that if provided with the meeting details in advance, a PA announcement can be made in the community.

In addition to the affected communities, other high priority stakeholders identified in the stakeholder register should be invited to attend.

Ongoing Stakeholder Outreach

After the ESA-specific consultation events have been completed, CH&PA should continue to engage with the community regularly to provide updates on Project progress and activities. Engagements should include the use of informational materials such as brochures, maps, and posters as more specific information on the Project becomes available.

CH&PA should also continue to actively monitor contact vehicles as the Project progresses, to ensure that stakeholder concerns continue to be identified, addressed, and actioned as necessary.

Documentation

CH&PA has established a stakeholder register that will be continually updated as additional stakeholders are identified, or as new information regarding stakeholders becomes known. CH&PA will also complete attendance records at every meeting, and will have designated note-takers at each meeting to document issues, concerns, suggestions and questions raised by attendees for consideration in the ESA and other Project planning processes.

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