



Project Name: Phase 1: East Bank-East Coast Road Linkage Project
(Ogle to Haags Bosch, Eccles)

Project Summary Report

Application for Environment Authorization for establishment of
An Asphalt, Crusher Run Macadam, Ready Mix Concrete Plant Diesel Generator
and Fuel Storage

Name of Developer: Ashoka Buildcon Limited

Submitted to:
Environmental Protection Agency,
Government of the Co-operative Republic of Guyana

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Chapter 1

Description of the proposed project

Project Background and locations.

The project “Construction of the East Bank – East Coast Road Linkage Project (Ogle to Eccles (Hags Bosch), Phase -1” is to be developed into 4 Lane divided highway configuration of length (7.705 km) while one Connector Road which is the extension of Haags Bosch Road is to be developed into 2 lane configuration of (length 3.580km). Total length of the project road is 11.285 km.

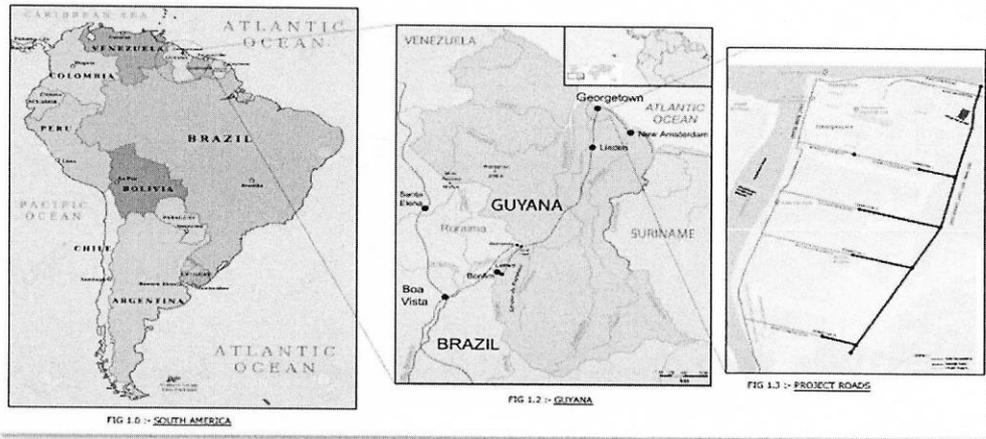


Fig 1: Stretch of the project.

The main alignment runs from East Coast (Ogle Airport) to Eccles (Haags Bosch). The proposed road will commence at the Junction of the Ogle Airport entrance Road and the East Coast Demerara Public Road. The Proposed Alignment follows the existing Ogle airport road for about 1.2 km. Thereafter, the proposed main alignment traverses through the abandoned cane fields.

The Connector – 2 takes off from km 7.705 on Main Alignment on RHS and joins with the existing Haag Bosch Road. The total length of connector 2 is 3.580 km including taper length for merging with existing Haag Bosch Road. The designed length of this connector is 3.580 km. The total designed length of main alignment (7.705 km) and Connector-2 (3.580 km) is 11.285 km.

We are going to install 03 plants i.e. Asphalt, Crusher Run Macadam, Ready Mix Concrete Plant and Fuel Storage for distribution at the camp area for execution of “Construction of the East Bank – East Coast Road Linkage Project (Ogle to Eccles (Hags Bosch), Phase -1”

Plant	Material	Approximate Qty.	Unit
Ready Mix Concrete	Cement	11,689.90	MT.
	Aggregate	172134.7	MT.
	Sand for Concrete Work	21,897.00	MT.

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	Admixture	59,013.00	Kg
	Water	5,299.00	KL
Crusher Run Macadam	Sand for Concrete Work	21,897.00	MT.
	Aggregate	172134.7	MT.
Asphalt Plant	Bitumen (Vg) 40	2,080.70	MT.
Diesel Generator	DG for Power Supply	25KVA-1NO.S, 62.5KVA-1NO.S & 125 KVA- 2NO.S	
Fuel Storage Tank	Diesel	15,000	Gallons

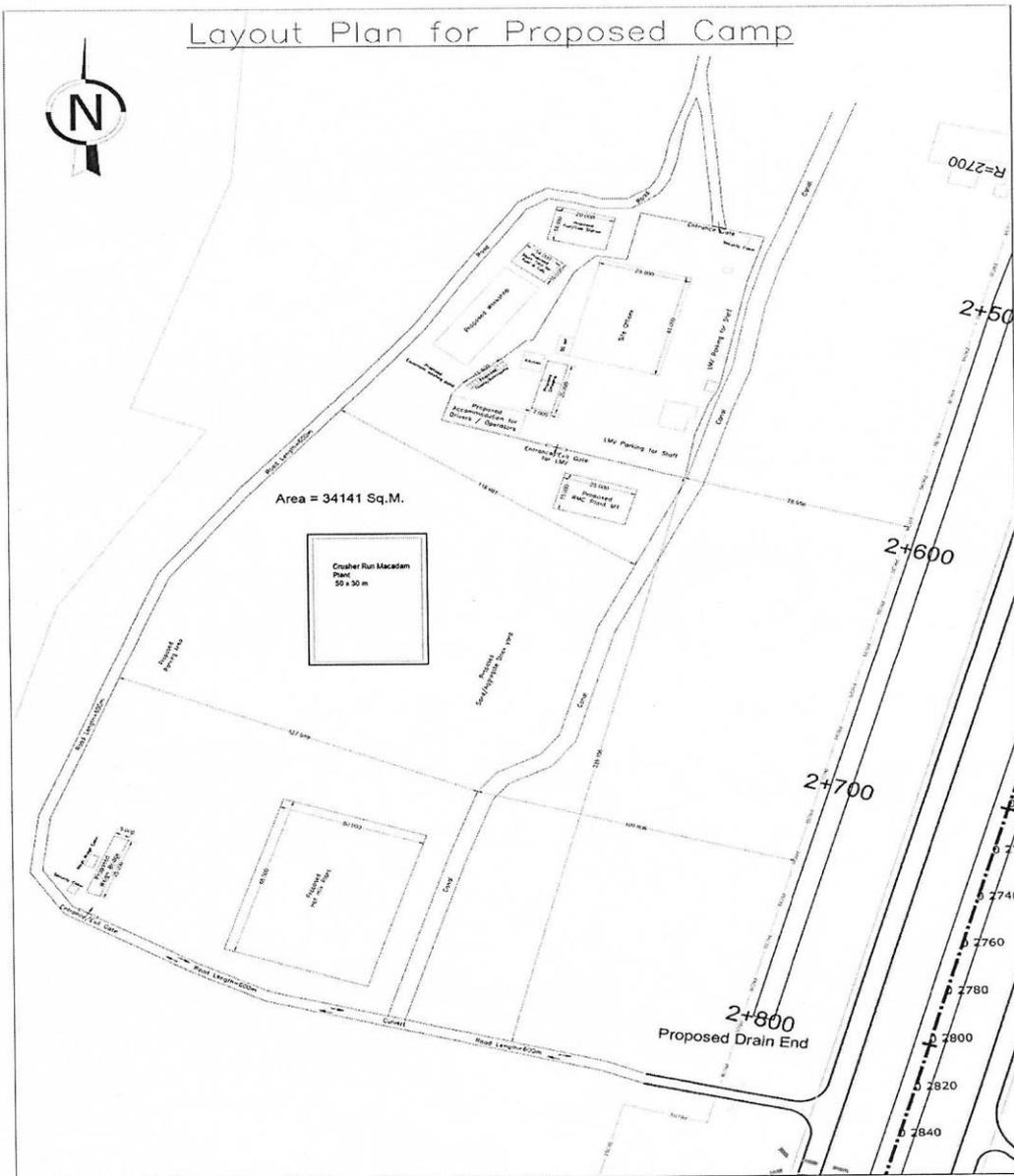


Fig-2: Layout of Proposed Camp

1.1 Project Details

Sr. No.	Description	Details
1.	Project Name	Phase 1: East Bank-East Coast Road Linkage Project (Ogle to Haags Bosch, Eccles)
2.	Total Length (Km)	Road: Main alignment (4 lane) - 7.705 km / Connector Road (2 lane) - 3.580 km Culverts: 14 / Minor Bridge: 4 / Major Bridge: 1
3.	Camp area	9 Acres of camp area will be utilized for office area, accommodation, Hot Mix Plant, Crusher Run Macadam Plant, ready Mix Concrete Plant, Diesel Generator & Fuel Tank
4.	Employer	Ministry of Public Works
5.	Project Funding	Exim Bank of India
6.	Borrower	Government of the Co-operative Republic of Guyana
7.	Construction Period	730 days
8.	Defects Notification Period	365 days
9.	Project details	<ol style="list-style-type: none"> 1. Phase-I involves Construction of the main alignment (East Coast–East Bank) for 7.80 kms from the Start Point, and Construction of Connector 2(Extension of Haags Bosch Road) for 3.58 kms 2. The main alignment being constructed originates at the Junction of the Ogle Airport entrance Road on the East Coast Demerara Public Road and ends at 7.8 Km on the main alignment. 3. The Connector 2 takes off from km 7.705 on Main Alignment on Right Hand Side (RHS) and joins with the existing Haags Bosch Road. 4. The total length of Connector 2 is 3.580 km including taper length for merging with existing Haags Bosch Road.
10.	Capacity	Ready Mix Concrete plant-60 Cubic meter per hour Hot Mix Plant: 90 MT per Hour Crusher Run Macadam Plant: 60 cubic meter per hour Diesel Generator: 25KVA-1NO.S, 62.5KVA-1NO.S & 125 KVA- 2NO.S Fuel Tank:15,000 Gallons
11.	Existing Road Details	Follows existing road up to 1.1 km and then deviates into Green field project

1.2 Physical location and its characteristics – GPS Coordinators

Location of Asphalt, Crusher Run Macadam, Ready Mix Concrete Plant and Fuel Storage at the Camp areas: Demerara-Mahaica, Guyana

GPS Coordinators: - 6°47'52.7"N 58°06'13.5"W

Following map showing the details of the base camp area and its nearby locations as per land use pattern

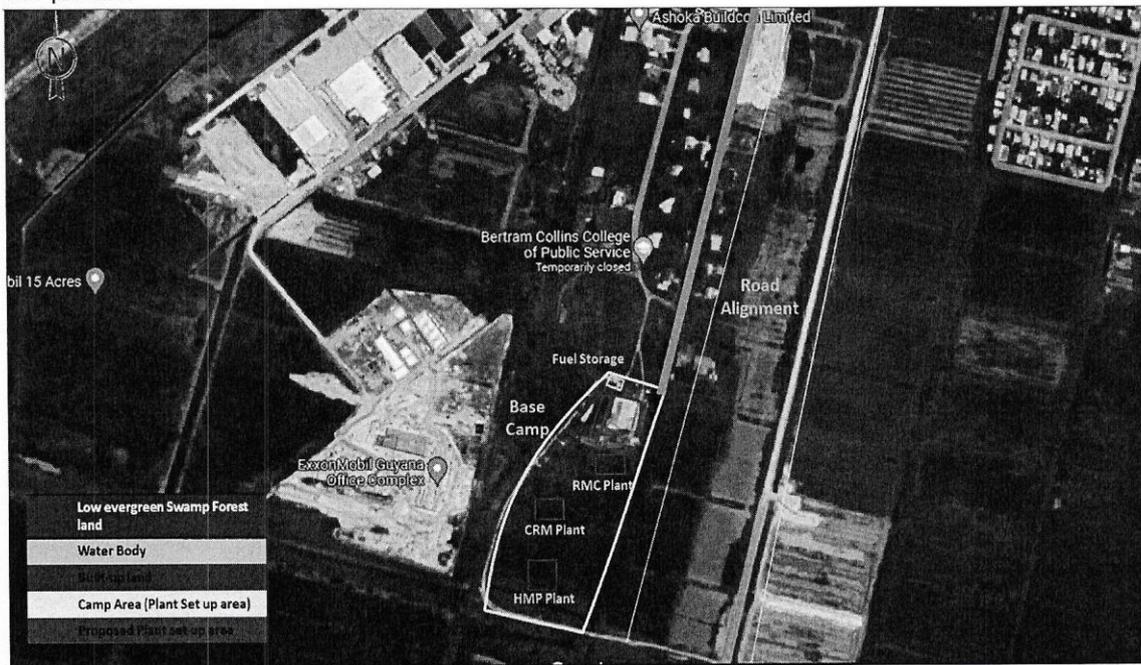
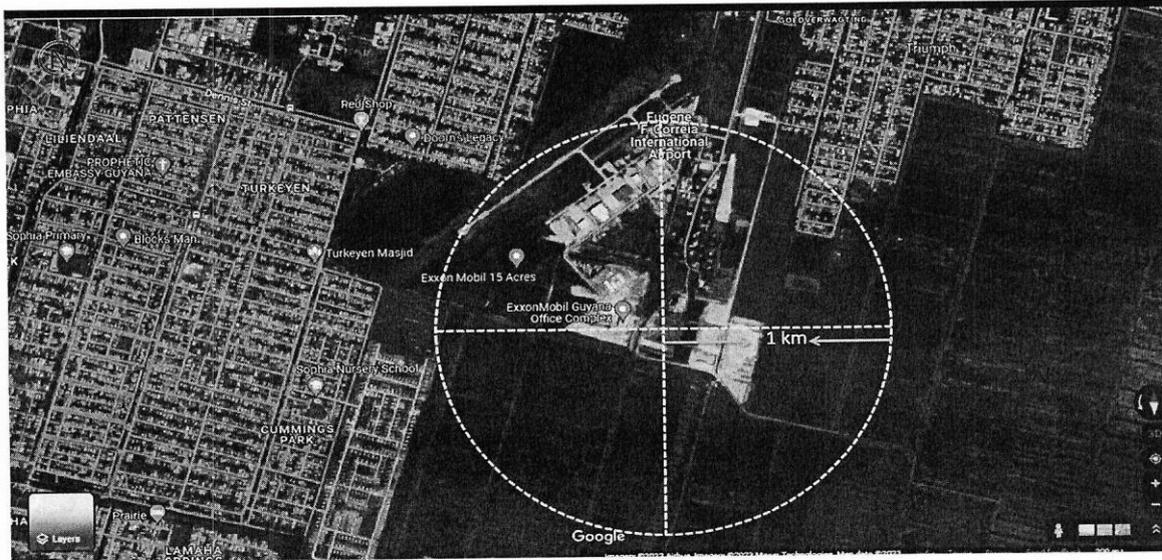


Fig-3: Layout of Gysuco Camp

The details of nearby locations and distance from the base camp are described in the following table.

Description	Details / Names	Distances
Closest Town	Ogle, George town	1.1 km
Settlement	Town Area	1.5 km
Indigenous community	Nil	----
Waterways	Canal	0.2 km
Land use pattern	Commercial area	0.6 km
Sensitive Receptors	Nil	No any school, hospital in nearby area within 1 km area. Airport
Natural resources	Nil	Nil
Non-disputed nature of the land	Nil	Nil



	North	East	South	West
Residential	YES- NORTH EAST		NO	YES- NORTH WEST
Commercial	YES -AIRPORT	NO	NO	NO
Institutional	NO	NO	NO	NO
Recreational	NO	NO	NO	NO
Industrial	NO	NO	NO	NO
Mixed Use – State	NO	NO	NO	NO

1.3 Description of existing baseline information on the physical, ecological, and social environment.

The baseline study was undertaken by the independent agency M/s. RITES (A government of India Enterprises under ministry of Railways) to determine the level of impact expected and to enable monitoring of impacts after the project is completed.

The baseline information has been drawn from both desk study and field survey. The baseline study records the quality of environment within the work area of influence before the project is implemented.

1.4.1. Water Resources

The construction activities will require large quantities of water which will be supplied mainly from nearby streams. Water will mainly be used for concrete mixing, dust suppression, and sanitary purposes. If there is not adequate water in nearby streams, then the Guyana Water Inc. (GWI) can be contacted as source water or other local contractors, especially to wet the access roadway.

Guyana has a network of rivers and streams with many rapids and waterfalls. Surface makes up

to about 10 percent of the country's drinking water and about 60 percent of George Town's drinking water.

The East Demerara Water Conservancy was developed in 1880 to channel a number of water sources into a storage area. It was formed using the natural gravity water flow from the upper southern parts of the country and has a bearing capacity of more than 100 square miles of water, thereby being the largest conservancy in Guyana.

The primary function of the conservancy is for the storage water for irrigation of sugar cane plantations, rice fields, and other cash crops during periods of drought. The Northern side of the Conservancy dam also protects the land between the conservancy and the sea (the coastal zone) against flooding from rainfall in the southern catchment area (see Figures below).

1.4.2. Guyana National Bureau of Standards Interim Guideline for industrial Effluent Discharge into the Environment

Discharges into the environment should be in accordance with the Guyana National Bureau of Standards interim guidelines for industrial effluent discharge into the environment. The following are the allowable limits for an operation and should not be exceeded.

- ◆ pH 5.0 - 9.0;
- ◆ Temperature <40°C;
- ◆ Biological Oxygen Demand (BOD) <50 mg/l;
- ◆ Chemical Oxygen Demand (COD) <250 mg/l;
- ◆ Total Suspended Solids (TSS) <50 mg/l ;
- ◆ Oil & Grease <10 mg/l;

1.4.3 Results of water quality and discussions

1.4.3.1. pH

The pH of water range from 0-14; lower the value the more acidic the substance; higher the value the more basic is the substance; while a pH of 7.0 is neutral. Each change in pH unit represents a tenfold change in acidity. A pH range of 6.0 to 9.0 appears to provide protection for the life of freshwater fish bottom-dwelling invertebrates (Kentucky River Basin Assessment Report and 2000).

All water samples tested were found to be between the recommended ranges set by the Guyana National bureau of standards for industrial effluent discharge. An important environmental; impact of pH is the effect it has on the solubility and bioavailability of substances, for example, mg/L of iron would not present a toxic effect at a pH of 4.8, however, 0.9 mg/L of iron at a pH of 5.5 can cause fish to die. Low pH can also have negative impacts on infrastructure

1.4.3.2 Conductivity

Conductivity is a measurement of the ability of an aqueous solution to carry an electrical current. All water samples tested were above the limit of 800µmho/cm set by Kentucky River Basin Assessment report 2000. Conductivity is a measurement used to determine the number of applications related to water quality, for example, determining mineralization: this is commonly called total dissolved solids. Total dissolved solids information is used to determine the overall ionic effect in a water source. Certain physiological effects on plants and

animals are often affected by the number of available ions in the water.

1.4.3.3 Suspended solids

According to the Kentucky River Basin Assessment Report 2000, 80mg/L of total suspended solids can decrease the macro invertebrate population by 60%. The results from locations 2, 3, 4 5, 9 and 10 are therefore high with regards to the Guyana National Bureau of Standards (GNBS) for Industrial Effluent Discharge into the environment. Suspended solids consist of an inorganic fraction (clays, etc.) and an organic fraction (algae, etc.) that are carried along by water as it runs off the land.

Ecologically, suspended solids can block fish gills, either killing them or decreasing their growth rate. They can reduce light infiltration which can reduce the ability of algae to produce food and oxygen. Suspended solids can result in siltation which can prevent the smooth flow of water thereby contributing to floods.

1.4.3.4 Fecal Coliform Bacteria

Indicator organisms such as fecal coliform bacteria usually do not cause disease, but they are used to detect the possibility of pathogens in water. Coliform bacteria are a collection of relatively harmless microorganisms that live in large numbers in the intestines of animals including man. They aid in the digestion of food. A specific subgroup of this collection is the fecal coliform bacteria, *Escherichia coli*

The criterion stipulated by Kentucky River Basin Assessment Report 2000 for swimming is fewer than 200 colonies/100 mL and for fishing and boating, fewer than 1000 colonies/100 ml similarly the criteria stipulated by USEPA, 1986, for the use of marine and fresh recreational waters (a GM of 33 enterococci cfu per 100 ml in fresh water and 35 enterococci cfu per 100 mL in marine water) and *E coli* for fresh recreational waters (a GM of 126 *E Coli* cfu per 100 mL) (US.. EPA, 1986. All water samples tested were greater than 200 Colonies/100mL; it therefore, means persons should be not entering unto these water bodies.

1.4.3.5 Hardness

Water hardness is a result of dissolved minerals in the water. Hardness is based on the ability of ions to react with soap to form a precipitate or soap scum. Hardness is classified as soft (0-75 CaCO₃ (mg/L)), moderately hard (75-150 CaCo₃ (mg/L)), hard (150-300 CaCO₃ (mg/L) and very hard (300 and up CaCO₃ (mg/L)) (Kentucky River Basin Assessment Report 2000).

All water samples tested were found to be less than 300CaCo₃ (mg/L) and therefore fall into the soft and moderately hard categories. The most important ecological effect hardness has on fish and other aquatic life is in the presence of other more toxic metals such as zinc, lead, cadmium and chromium, the harder the water the lower the toxicity of other metals to aquatic life.

1.4.2 Soils, Land and Geology

Land is the terrestrial part of the earth's surface and is an area or location where we can live and carry out activities for subsistence, wealth-creating employment leisure activities, and other lifestyle choices. Soil is the top layer of the terrestrial part of the surface of the earth (i.e. land). It contributes towards terrestrial ecosystem services that people rely upon when they use the land for food, shelter and biomass production and these are central to social, economic and environmental sustainability. Soil is a component/subsystem of terrestrial ecosystems, providing a growing medium for flora and habitat for fauna. Soil is one of the main environmental receptors of development impacts.

The project camp is located in the Gysuco camp, Ogle air strip, Ogle East Coast Demerara. The project camp will be utilized as office area, accommodation purpose of Operators & drivers, and Production plants like Hot Mix Plant, Crusher Run Macadam plant and Ready mix concrete plant

1.4.2.1 Environmental Protection (Hazardous Wastes Management) Regulations, 2000

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

- 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
- Materials capable, after disposal, of yielding another material which possesses any of the characteristics specified above

The fuel used to power equipment is also classified as a hazardous material. The hazardous wastes regulations will, therefore, apply to fuel oil/used oils at the project site.

1.4.3. Air Quality

The development has the potential to alter air pollutants concentrations from the baseline situation and may affect people, plants, animals, materials and buildings. Development also has the potential to create a local dust nuisance due to operation of plants to earth-moving and material-handling operations and during periods of dry weather if appropriate mitigation measures are successfully implemented. Combustion engines may give rise to both routine and non-routine pollutant emissions. Non-routine emissions may include accidental releases

Coarse particles are airborne pollutants that fall between 2.5 and 10 micrometers in diameter. Fine particles are airborne pollutants that fall below 2.5 micrometers in diameter. Sources of coarse particles include crushing or grinding operations, and dust stirred up by vehicles traveling on roads. Sources of fine particles include all types of combustion, including motor vehicles, residential wood burning, and some industrial processes.

1.4.3.1 Policy, Legislation and Regulatory Framework

1.4.3.1.1 Environmental Protection Air Quality Regulations 2000

Environmental Protection (Air Quality) regulations were developed in 2000 under the Environmental Protection Act 1996. In accordance with these regulations anyone who emits any air contaminant in the construction, installation, operation, modification or extension of any facility related to industry, commerce, agriculture or any institution shall apply to the EPA for an environmental authorization and shall apply to the EPA at least one hundred and eighty days before the date on which the emission is to commence. In accordance with the regulations, the EPA shall establish parameter limits with respect to the emission of smoke, solid particles, sulfuric acid mist or sulfuric trioxide, fluoride compounds, hydrogen chloride, chlorine, hydrogen sulfide, nitric acid or oxides of nitrogen and carbon monoxide. No parameter limits have been mandated to date.

1.4.3.1.2 WHO Guidelines

The WHO guideline values are based on the lowest concentration of a pollutant that has been shown to produce adverse health effects or the level at which no observed health effect has been demonstrated, plus a margin of protection to safeguard sensitive groups within the population. Sensitive groups include people with asthma, those with pre-existing heart and lung diseases, the elderly, infants, and pregnant women and their unborn babies. Some pollutants, notably carcinogenic pollutants (e.g. arsenic, benzene, chromium, polycyclic aromatic hydrocarbons (PAHs) and vinyl chloride have not been given a guideline value. Instead, exposure-effect information is provided, giving guidance to risk managers about the major health impact for short- and long-term exposure to various levels of this pollutant.

The WHO guideline values are based on health considerations alone and do not consider the technical feasibility or the economic, political and social dimensions of attainment. In the absence of parameter limits, this project proposes to adhere to WHO Ambient Air Quality (2007) and World Bank Guidelines. The WHO ambient air quality guidelines are detailed below

Pollutant	Averaging Time	Guideline Value
PM 2.5	24 h	25 µg/m ³
	Annual	10 µg/m ³
PM 10	24 h	50 µg/m ³
	Annual	20 µg/m ³
Nitrogen dioxide	1 h	200 µg/m ³
	Annual	40 µg/m ³
Sulphur dioxide	10 min	500 µg/m ³
	1 h	
	3 h	
	24 h	20 µg/m ³
Carbon monoxide	15 min	100 µg/m ³
	30 min	60 µg/m ³
	1 h	30 µg/m ³
	8 h	10 µg/m ³
Ozone	8 h	100 µg/m ³
Benzene	Annual	20 µg/m ³

WHO Air Quality Guidelines

Particulate matter (<10 mm)

Annual Arithmetic Mean 100 mg/m³

Maximum 24-hour Average 500 mg/m³

Nitrogen Oxides as NO₂

Annual Arithmetic Mean 100 mg/m³

Maximum 24-hour Average 200 mg/m³

Sulphur Dioxide

Annual Arithmetic Mean 100 mg/m³

Maximum 24-hour Average 500 mgm³

1.4.4 Noise and Vibrations

Noise is essentially unwanted sound and deals with people's subjective responses to objective reality. It is the annoyance caused by noise that is critical in ESIA. Sound consists of pressure variations that are detectable by the healthy human ear. These pressure variations have two key characteristics: frequency and amplitude. Sound frequency refers to how quickly the air vibrates, or how close the sound waves are to each other (in cycles per second, or Hertz (Hz)). Environmental noise can be dominated by a particular frequency or it may be described as 'broadband', i.e. comprises a range of different frequencies.

1.4.4.1 Policy, Legislation and Regulatory Framework

1.4.4.1.1 Environmental Protection Noise Management Regulations 2000

Under these regulations operations that emit noise in the execution of various activities such as construction, transport, industry, commerce, and other institutions are required to apply to the agency for an environmental authorization. The EPA is responsible for the establishment of standards for permissible noise levels in industry, construction and other areas. The categories for which permissible noise levels are fixed by the EPA are as follows: Residential, Institutional, Educational, Industrial, Commercial, Construction, Transportation and Recreational. The Guyana National Bureau of Standards (GNBS) and the EPA together with other relevant agencies developed Interim Guidelines for Noise Emission into the Environment. Under these guidelines, noise emissions from Industrial and Commercial sources for both days (06:00h – 18:00h) and night (18:00h – 06:00h) would be 100 and 80 decibels (Industrial) and 80 and 65 decibels (commercial) respectively at the property boundary or 15 meters from the source.

1.4.4.1.2 World Health Organization

The Guidelines for Community Noise (WHO 1999) are health-based guidelines that incorporate influential noise standards as part of a framework for noise management. The guidelines recommend internal and external noise levels that will prevent detrimental effects on a community, including rest, sleep, and work that requires concentration, amongst others;

To protect the majority of people from serious annoyance during the daytime, the noise level on balconies, terraces and outdoor living areas should not exceed 55 dB LAeq for a steady continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor noise level should not exceed 50 dB LAeq

1.4.5. Hazardous Waste and Waste Management Material

Chemicals such as epoxy, gypsum, additives, admixtures, cement, bitumen, oil and Diesel used for construction activity. The Environmental Protection Hazardous Waste Management Regulations provides regulations for chemical waste control and administers the possession, storage, collection, transport, and disposal of chemical wastes. Impacts can arise throughout the waste management supply chain and therefore the generation, storage, collection and transport, reuse, recycling, recovery, treatment, and disposal of waste are all taken into account when assessing impacts. The impacts can be derived from inert waste or construction and demolition materials such as surplus excavated soil and rock, rubble and bricks; non-hazardous waste or general reuse such food waste, packaging waste and other general wastes from construction, businesses, industry and households; and hazardous or chemical waste such as oils, batteries and other waste exhibiting hazardous properties.

Waste is considered to be inert if it does not undergo any significant physical, chemical or biological transformations; and does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. Certain categories of municipal, industrial and construction waste (e.g. brick rubble) may be considered inert.

1.4.5.1. 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:

- ◆ 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 system

Material capable, after disposal, of yielding another material which possesses any of the characteristics specified above.

Chapter 02

Description of the project design

1. Design / construction, drawings, specifications:

The project is located in Georgetown which is the capital of Guyana, officially the Co-operative Republic of Guyana, is a sovereign state on the northern mainland of South America.

The scope of work will broadly include phase-I Construction of the main alignment (East Coast-East Bank) for 7.705 km from the Start Point and the Construction of Connector 2 (Extension of Haags Bosch Road) for 3.58 km each of the constructed lanes will be 3.6 m wide construction and/or rehabilitation of major and minor bridges culverts road intersections interchanges drains etc. Construction period is of 2 years and maintenance of the Project during the Defect Liability Period, will be 1 year.

2. The project size

Main Alignment includes the construction of 7.705 kilometers Asphaltic Concrete Surface Four-lane road. Out of which 1.3 km is two lane road that has to be widened to four lane and rest to be constructed is completely a new four lane alignment on the greenfield. The road will comprise of bituminous concrete surface, a base, sub-base and subgrade. A 4.2 meters median will be constructed in the center to separate the four lanes thereby allowing for two lanes of traffic flow in either direction. Each of the constructed lanes will be 3.6 m wide.

There are fourteen (14) culverts and seven (7) minor bridges to be constructed apart from these structures other 10 culverts need to be constructed on T-junctions. Reinforced concrete drains, Stone pitched drains, earthen drains, concrete sidewalks and a utility corridor will be constructed along the length of the roadway. Ground improvement works like installation of PVD's & geotextiles are proposed. The road safety features will include streetlights placed on the medians to illuminate both sides of the four-lane road. Traffic and regulatory signs will provide guidance and warning to commuters. Connector 2 - The connector road at Eccles Haags Bosch includes the construction of 3.58 kilometers of Asphaltic Concrete two lane roads. The road will comprise of bituminous concrete surface, a base, sub-base and subgrade, each lane will be 3.6 meters. There are Six (6) culverts and three (3) minor bridges & (1) major bridge on Lama canal that are proposed to be constructed.

The earthen drains and a utility corridor will be constructed along the length of the roadway.

The road safety features will include street lights while, traffic and regulatory signs will provide guidance and warnings. In addition, one major bridge is proposed to be constructed over the Lama Canal.

3. Activities associated with all development stages

The project construction phases includes following major activities which will be undertaken during the completion.

- Site Clearance & Dismantling
- Earthworks
- Non Bituminous Granular Sub Base & Base and Shoulders
- Bituminous Base and Surface Course
- Culverts
- Bridges
- Drainage and Protection Works
- Road Signs and Road Appurtenances

4. Operation and production processes and alternative design/s,

The road construction activities will be performed with the help of mix designed products by using the production process like ready mix concrete, hot mix plants, Crusher Run Macadam etc. Plants details and its capacity details are as follows:

- Ready Mix Concrete plant-60 Cubic meter per hour
- Hot Mix Plant: 90 MT per Hour
- Crusher Run Macadam Plant: 60 cubic meter per hour

Fuel storage tank will be installed at the base camp area with proposed size of 20 m x 14 m size. The distribution of fuel will be carried out for construction machinery. The operations of fuel distribution are carried out with safe operating procedures and required fire control measures will be installed at the station to handle any kind of emergency.

5. Details of raw material to the finished product;

Raw material like Aggregate, Cement, Sand for Concrete Work, Admixture, Water, Bitumen (Vg) 40 etc. will be used for production purpose. Finished products include ready mix concrete, hot mix, Crusher Run Macadam etc. which will be used for construction of proposed road alignment.

6. Technical description & process Flow Diagram/s;

Detailed feasibility reports of Ready Mix Concrete, Crusher Run Macadam and Asphalt Plant are attached as annexures which includes technical description and process flow charts.

7. Details of Natural Resources:

The Road construction will be carried out using various raw materials which will be sources from the local availability and approved suppliers.

Material	Approximate Qty.	Unit
Cement	11,689.90	MT.
Sand for Concrete Work	21,897.00	MT.
Aggregate	172134.7	MT.
Admixture	59,013.00	Kg
Water	5,299.00	KL
Bitumen (Vg) 40	2,080.70	MT.

8. Details of utility services

1. Electrical Energy - Diesel generators will be used for electrical supply for plant operations.
2. Water will be used for plant operations by local suppliers from river source

9. Waste Management :

The following strategies shall be adopted for appropriate solid waste collection system to be functioned properly:

1. Setting waste management points (not permanent structure, movable high-quality movable plastic bins; in strategic points of the construction camp and work sites.

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2. Introduce solid waste bins for organic and non-organic waste.
3. Coordinate with the local agency for disposal of waste.

Following are the details of probable quantity of waste generated and method of disposals

Plant	Material	Disposal and Reuse methods
RMC	<ul style="list-style-type: none"> • Concrete waste from RMC Plant 	<ul style="list-style-type: none"> • A Concrete waste management in order to reduce the amount of returned generated concrete or spilled concrete, it is important to make the prior planning in detail, so that the above concrete could be used elsewhere (in house purpose or by external users). • The returned concrete can be used for the following purposes. Concrete products can be used to develop in-house products such as sheds, floors, platforms, haul, roads, flower pots, safety delineators, cones etc. where the quality of the concrete is not a criterion. Concrete also could be donated to the nearby areas for their housing construction which strengthens the community relationships.
	<ul style="list-style-type: none"> • Batching Plant waste 	<ul style="list-style-type: none"> • Reuse and recycle of solid waste at a batching plant • Aggregates extracted from the used washing water from the RMC batching plant operations should be used for road sub-bases and aggregates for the concrete. • Sludge cake generated from the RMC batching plant treatment unit should be used for the road sub bases after being treated with consolidation; as a raw material for cement and for concrete products. • Fine powders of dry sludge obtained from the batching plant settling through the process of drying and grinding should be used for the addition of concrete, hardening soft ground, and deoxidizing acid soil.
	<ul style="list-style-type: none"> • Used Oil 	<ul style="list-style-type: none"> • Use as shuttering oil for easy release and clean surface of shutter • For vehicle maintenance work • Used oils can also be used on form boards to allow for easy stripping and chain saws as lubrication
ASPHALT PLANT	<ul style="list-style-type: none"> • Spill Bitumen 	<ul style="list-style-type: none"> • Reuse in Asphalt plant for production purpose

The details of waste management practices are included in the feasibility reports attached as Annexure 01, 02.03 for RMC, CRM and Asphalt Plant.

10. Project Construction duration

The scope of work will broadly include phase-I Construction of the main alignment (East Coast-East Bank) for 7.705 km from the Start Point and the Construction of Connector 2 (Extension of Haags Bosch Road) for 3.58 km each of the constructed lanes will be 3.6 m wide construction and/or rehabilitation of major and minor bridges, culverts, road intersections and interchanges drains etc. Construction period is of 2 years and maintenance of the Project during the Defect Liability Period, will be 1 year.

Construction Period	730 days
Defects Notification Period	365 days

11. Decommissioning plan

The Plants will be dismantled after completion of project activities and the area of plant set up will be redeveloped as per the actual conditions. The materials will be removed for recycling and recovery from the work locations to approved containers or storage area as required. If materials are sorted on site, also provide a sorting area and necessary storage containers.. Deposit indicated recyclable, and recoverable materials in storage areas or containers in a clean (no mud, adhesive, solvents, petroleum contamination), debris-free condition. Do not deposit contaminated materials into the containers until such time as such materials have been cleaned. Ensure all recovered materials are made safe for handling and storage.

Chapter-3:

Potential Impacts and their Significance

This chapter presents the Environmental and Social Impact Assessment (ESIA) study undertaken for the construction of the Camp area (Plant setup area).

3.1 Assessment of Environmental Impacts

This ESIA defines direct impacts as environmental changes directly associated with project activities. The impact assessment, in this ESIA, is based on the following:

- An understanding of the nature of the proposed project, including project design, construction activities, timing, and decommissioning.
- Information about the relevant receptors and how they respond to changes/disturbances.
- The effectiveness of mitigation measure for similar projects
- Existing and previously approved projects which can contribute to cumulative impacts

Both qualitative and quantitative methods were used to determine the magnitude of impacts (severity), duration, reversibility/irreversibility and geographic extent in addition to the frequency of impacts. Qualitative assessments employ ratings such as neutral, slight, moderate or large and are applied to both negative and positive impacts. Qualitative assessments are used where quantitative assessments are difficult or impossible, for instance in a landscape, archaeological, or biodiversity assessment. Quantitative assessments involve measurement or calculation of numerical values, e.g. the level of a pollutant in relation to a statutory threshold value.

Information on potential impacts from the construction and operation of the project has been obtained from various sources, including consultation with the EPA, the public consultations process, ESIA's for similar projects in Guyana and worldwide; literature, research, and independent modeling and analysis. The project team used professional judgment, fieldwork, and computerized analysis to identify potential impacts and their interactions. The methodology which was used to identify and assess the potential physical and social impacts of the proposed project is described in the following sections.

The assessment of impacts for each environmental component followed the sequence below:
Characterization of the baseline undertaken;

- Identification of the sources of impacts and the impacts themselves for specific environmental components, during the construction operation and closer phases of the project.
- Rating of the impacts on a specific environmental component, before any mitigation (for negative impacts) or enhancement (for positive impact) is implemented.
- Recommended mitigation and enhancement measures on a specific environmental component to address the impact.
- Rating the impacts after mitigation, on a specific environmental component, to produce a "residual" impact rating

3.2 Extent of Impacts:

This ESIA defines geographic extent as to how far an effect propagates. Localized adverse environmental effects may not be significant, while widespread effects may be significant. Geographic extent considers the extent to which environmental effects, caused by the project, may occur in areas far removed from it.

The geographical area of the influence that may be affected due to proposed activity will be a circle of approx. 1 km radial distance from camp area in terms of various aspects of the environment such as,

1. Physical impacts on landscape, soil, water, air and natural resources:

Typical of these would be changes of topography/ landscape, erosion and dust emissions, soil quality alteration in particular area, water quality alterations in nearby adjacent stream, use of natural resources water and aggregate.

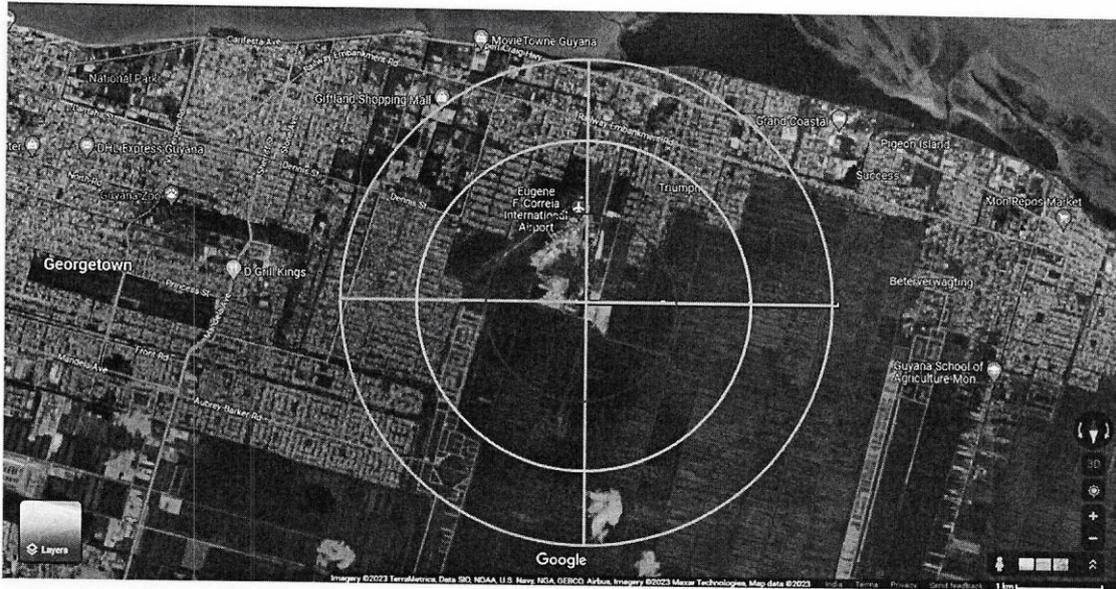
2. Ecological impacts on flora and fauna:

Indirect impacts are defined as environmental changes not directly associated with project activities which occur at a distance from the project because of complex pathways. Indirect impacts are referred to as second or third level impacts or secondary impacts. This ESIA also considers induced development impacts, including possible increases in population and related environmental impacts and cross-media impacts.

Following the loss of vegetation caused by the road's construction in a given location, the land use pattern will alter. As a result, some biological changes may take place in the flora and fauna's habitats.

3. Social impacts on economic and cultural aspects.

The categorization of impacts into positive or negative (adverse) impacts is not necessarily simple as project impacts may have both positive and negative effects, for example, one group may benefit while another is disadvantaged or the impact may be positive socio-economically but not ecologically. Local skilled unskilled workers will find employment during the construction period. The underdeveloped region of Georgetown City will be developed in addition to the socio-economic benefits. Temporary noise pollution may create disturbance in social life due to various construction activities.



Location of Proposed Camp

Distance	Population	Impact
0-1 Km	Scattered Population	Negligible
1-2 Km	Scattered Population	Negligible
2-3 Km	Moderate population	Moderate

3.2.1 Impacts on Water Environment:

Impact Prediction and Evaluation

Ground water quality may be negatively impacted during maintenance work of machineries/ equipment's and Hot mix plants accidental discharges of fuels, oils, and grease. These are high impacts (medium-term, high severity, regional extent). The potential for accidental spills of fuels, oils, and grease and the associated contamination of ground water will be minimized by implementation of a Spill Prevention and Contingency Plan. This plan detail measures which will be implemented to prevent, and if necessary, contain spills of fuels, oils, or other contaminants.

Spills of fuel and oils from equipment and from fuel storage can flow to the underlying aquifer and potentially impact groundwater quality. This will result in high impacts (long term, high severity, regional extent) to ground water quality. Potential combination of the underlying aquifer will be minimized by installing drip pans on all equipment, enforcing a program to check for equipment leaks and implementation of the Spill Prevention and Contingency Plan (SPCP). The SPCP will detail plans for utilization of sorbents, biological agents, chemical dispersants and gelling agents. All fuel will be stored within containment walls designed to contain 110 percent of the tank contents. Implementation of these mitigation measures will result in low residual impacts (short-term, low severity, local extent) to groundwater quality.

Project phase	Conditions	Potential environmental impact	Significance
Construction and Rehabilitation phase	fuel/oil spills	Water contamination from fuel/oil spills	Ex, Irr, LT, Av, M, Sig
	Erosion and Sedimentation	Surface runoff to water ways from construction activities: culvert, bridge and road construction; base camp resulting in discoloration and sedimentation.	Lo, Rev, ST, Av, M, Sig.
	Waste disposal	Improper disposal of solid waste from worker camp.	Ex, Re, LT, Av, M, Sig.
Operational phase	Water	Contamination and siltation as a result of erosion and sedimentation	Ex, Re, LT, Av, M, Sig
		Contamination from spills such as fuel and waste oil	Ex, Irr, LT, Av, M, Sig
		Contamination of soil from insecticide/chemical spills	Lo, Irr, ST, Av, M, Sig
		Contamination from improper waste disposal including solid and liquid waste	Ex, Re, LT, Av, M, Sig
Impact Significance Parameters			
Lo – Localized	Ex – Extensive	Rev – Reversible	Irr. Irreversible
ST – Short Term	LT – Long Term	Av. – Avoidable	Un - unavoidable
Sig. – Significant	Insig. –Insignificant	M. – Mitigable	UM – Unmitigable

Table 3.1: Summary of Water Resource Impact

3.2.2 Soils, Land and Geology

Impact Prediction and Evaluation

Potential impacts to soil could result from the development of the roads and the connectors from vegetation clearance of the project area and infrastructure area footprints. Soil is a complex ecosystem containing millions of living things, including small rodents, insects, worms, algae, fungi, and bacteria. These organisms are important for mixing, aerating the soil particles and aiding in the release or conversion of nutrients in soils into forms that are useful for plants. The development and maintenance of the terrestrial ecosystems, in the project area, depends upon the surficial soils as basic components of the system. Construction activities will result in soil degradation since minerals necessary to support the ecosystem may be depleted by construction activities. These are moderate impacts (long-term moderate severity, local extent).

The construction will be restricted to the proposed project area; compaction, rutting and erosion would, therefore, be localized to these areas. These impacts to soil resources are expected to be low (short-term, low severity, local extent). No mitigation would be required. The environmental impacts that are likely to result from the aforementioned activities

Project Phase	Conditions	Potential environmental impact	Significance
Construction and Rehabilitation Phase	Land clearing for the construction of the base camp and roads.	Loss of land through direct land takes for project components. Removal of vegetation, where necessary, to facilitate construction of project facilities, thus, may contribute to erosion.	Lo, Irr, LT, Un, M, Insig.
Disposal of Materials (vegetation).	Improper disposal of vegetation from land clearing.	Lo, Irr, LT, UM, Un, Insig.	Disposal of Materials (vegetation).

Table 3.2: Potential Impacts and their Significance

3.2.3 Air Environment:

Production of construction materials works will result in emissions of fugitive dust and products of combustion. Dust generated would be a function of construction activities, soil type, and moisture content, and wind speed, frequency of precipitation. Dust is broadly defined as small solid particles created by the break-up of larger particles. Depending on their size, dust particles can become hazardous to worker health, particularly when suspended in the air. The largest size particle that can be suspended in the air for long periods of time from wind velocity acting upon it is about 60 micrometers (µm), which is about the thickness of a human hair.

Products of combustion will include Benzene, PM10, PM2.5, carbon monoxide, NOx, SO₂, VOCs –a precursor of ozone and hydrocarbons. Ozone, sulfur dioxide, fine particulates, and nitrogen dioxide have both acute and chronic health effects. Carbon monoxide has acute effects only, whereas lead, being a toxic metal, has chronic effects (at ambient air levels). Ozone is a strong oxidizer that affects the respiratory system and may lead to damage to lung tissues. Its acute effects include cough and chest pain, eye irritation, headaches, lung function losses, and asthma attacks. The acute effects of sulfur dioxide include irritation and restriction of air passages. There is reduced mucus clearance from the restricted air passages and chest tightness. Under normal conditions, the lung passages are open, however, the lung passages constrict in a response to SO₂. This constriction further aggravates other health conditions. Sulfur dioxide also causes immune system suppression and increases the probability of bronchitis. There are some indications that chronic exposure to sulfur dioxide may also act as a cancer promoter in addition to an immune system suppressor.

Exposure to elevated concentrations of fine particulates increases mortality rate, increases the incidence of asthma and bronchitis, and rates of infection in the respiratory system. Particulates also directly irritate the respiratory tract, constrict airways, and interfere with the mucous lining of the lung passages. The chronic effects of fine particulates include loss of lung capacity and lung damage, resulting from scarring caused when fine particulates are not cleared from the lung passages or alveoli. Fine particulates also act as carriers for toxic contaminants and heavy

metals particularly when the contaminants exist in a fume or a vapor state and condense onto the fine particulates. In the alveolar regions, heavy metals may be absorbed into the blood and circulated to other parts of the body. Particulates and fine particulate fractions are also responsible for visibility reduction.

Stripping topsoil and overburden will generate dust when undertaken in the dry season. Dust emissions from asphalt plant and milling equipment, material stockpiles, and other fugitive dust-generating operations would occur over the duration of the operation. This will result in moderate impacts (medium-term, moderate severity, local extent).

3.2.4 Noise Environment:

Impact Prediction and Assessment

Production of construction material activities will produce noise levels above the WHO industrial/commercial noise level guideline value of 70 decibels (dBA) from Hot mix plants and Ready mix concrete plant. Maintenance operations in workshops will generate noise levels about 72-110 dBA. Noise levels from the power generation plant will range from 90-105 dBA. Exposure to noise levels above 90dBA can cause noise-induced hearing loss. Noise levels above the tolerable threshold of 72 decibels may result in fatigue, tiredness, low morale and decreased production levels. Primary noise receptors in the area will be individuals involved in construction activities at the site. There are several communities close to the project boundaries. Tired workers are prone to accident which may contribute to an increase in work-related accidents. These are high impacts (medium-term, high severity, local extent).

Construction phase noise will have an adverse effect on many species of wildlife that are

- ◆ Installation of soil berms as noise barriers to mitigate noise impacts adjacent to work site areas;
- ◆ Installation of sound suppression devices (such as mufflers) on earthmoving equipment generators, etc.;
- ◆ Avoiding unnecessary idling of vehicles and machinery that are used intermittently
- ◆ Employing the best available work practices on-site to minimize occupational noise levels and
- ◆ Provide personal protective equipment (PPE) to employees and contractors and requiring their usage under the health and safety plan

Implementation of these measures would result in low residual impacts (short-term, low severity, local extent).

A nuisance to nearby properties is likely to result from

- ◆ Noise and vibration from Diesel generator
- ◆ Dust during Hot mix plant, Crusher Run Macadam and Ready Mix plant production
- ◆ Gaseous emissions from heavy equipment;
- ◆ Fumes from asphalt boiling sites.

Noise is expected to be a significant environmental impact that requires mitigation, especially to reduce the impacts on workers. Appropriate mitigation measure will be implemented to reduce impact on noise environment.

The magnitude and complexity of the impacts:

Impact magnitude measures the severity of environmental effects. Effects range from minor or inconsequential with little significance to major or catastrophic with significant adverse environmental effects which may be unacceptable. When considering the magnitude of potential impacts, the development was considered within the context of regional development and the extent to which the project could trigger or contribute to any cumulative effects.

3.3 Probability of impacts:

In this ESIA, likelihood, is defined as the probability of an impact occurring. Two criteria are considered when examining likelihood: (1) probability of occurrence: if there is a high, medium or low probability that a particularly significant environmental impact will occur, (2) the certainty of significance: the level of uncertainty associated with the environmental assessment, often termed as 'confidence limit'. If confidence limits are high and impacts are evaluated as significant, there is a high degree of certainty that the conclusions are accurate and environmental impacts are significant. If confidence limits are low, there is a high degree of uncertainty about the accuracy of conclusions, and it will be difficult to decide whether significant environmental effects are likely or not.

3.4. Duration, frequency and reversibility of impacts:

Reversibility, in this ESIA, refers to the environmental recovery once an impact has occurred. Irreversible environmental impacts are commonly considered more significant than those that are reversible. Irreversible changes always command attention because they signal a loss of future options.

Duration, within this ESIA, considers the period over which an environmental effect occurs. Long-term environmental effects may be significant. Short-term environmental effects may also be significant, especially if the short-term effects negatively affect public perception of a project. Frequency is closely related to the duration of the environmental effect. The frequency of effects and the potential of the environment to recover from these effects are important. If an activity is intermittent, for example, it may allow for environmental recovery during inactive periods.

3.5 Cumulative Impacts

Cumulative impacts are mostly indirect and defined as incremental environmental changes caused by independent or repetitive activities. These impacts may occur as interactions between activities, between an activity and the environment, and across environment media. Cumulative effects can occur in many ways including (CEAA 2003; Spalding 1994).

A physical or chemical constituent can be transported away from the impact source only to interact with another activity or environmental medium (e.g. soil erosion or acid rock drain-age) The gradual disturbance and loss of land and habitat, or nibbling loss (e.g. incremental land clearing as the mine advances or incremental road development into forest areas, alienating wildlife habitat due to sensory disturbances.

The study area is accompanied by an airport, a sugar factory, and other industry. There isn't a chance that nearby businesses would be negatively impacted, but once the road constructions are finished, current businesses will have improved connectivity, which is good for them.

Spatial and temporal crowding, when too much is happening within too small an area and/or in too brief a period. Spatial crowding includes overlapping effects from separate activities (e.g. downstream confluence of effluent plumes from multiple discharge points). Temporal crowding occurs when impacts from different actions overlap or occur before the receiving environment

has had time to recover (e.g. family stress due to continuous fly-in/fly-out employment).

Each impact can induce further effects, sometimes called growth-inducing potential. The effects of these spin-off impacts (e.g. increase in hunting or trade of endangered species due to improved access to areas) may add to the cumulative effects near the mine. The magnitude of cumulative effects, or the impact propagation between causes and effects, can equal the sum of each individual effect (additive effects) or can result in an increased effect (synergistic effect). There are many other examples of cumulative impacts; incremental noise from independent activities (either from one or several projects) or the cumulative effect of individual impacts on a receptor, such as human stress due to combined noise and dust exposure, or visual impacts. Impact interactions, a subset of cumulative impacts, can occur either between the impacts of one project or between the impacts of several projects

The opposite cumulative impacts are cancelling, offsetting or compensating impacts. These are also quite common. Examples include water abstraction that is offset by water discharges or increases in traffic offset by improvements in capacity of local roads. The objective is to generate impacts that will offset the significant adverse impacts.

3.7. Social Impact Management:

Road construction projects impacts may be positive or negative such as loss of structures and vegetation, rehabilitation; change in land use, city/ town connectivity followed by development, etc. The coordinates of project camp and base RMC, HMC and CRM are 6.8037, -58.102711. Aerial distance of the nearest city Georgetown from the project base camp is 1.5km. The population of Georgetown is approx. 240,000 (source <https://worldpopulationreview.com>).

But only the part of the city lies within 1 km radius from the project base camp will face the temporarily environmental issues like air and noise pollution, it is negligible and can be minimized by using wind braking wall, water sprinkling, canopy for belt conveyor and acoustic enclosures for DG SET.. Otherwise there are no negative impacts will occur on the social life in surrounding area.

Impact Identification:

Sr. No.	Impact	Mitigation Measures/ Social Benefits				
1.	Easy access and connectivity to nearby facilities	Positive Impact: Travel time will be saved for public. Easy approach to the surrounding area like airport, local markets, health, education, church, safety in public transport, Road business activities, etc.				
2.	Employment generation for local groups	Positive: During the period of construction local people will get employment.				
3.	Developmental Activities	Availability of better connectivity gives scope to the developmental activities within the area.				
4.	Disturbance to the nearby people due to noise pollution during construction activities	It will be negligible impact during construction phase only for short term				
5.	Respiratory health issue to nearby habitat because of air contamination due to	Best industrial practices to reduce air pollution. <table border="1" style="width: 100%;"> <tr> <td>Plant</td> <td>Control measures</td> </tr> <tr> <td>Camp Area</td> <td>Wind breaking wall, water sprinklings,</td> </tr> </table>	Plant	Control measures	Camp Area	Wind breaking wall, water sprinklings,
Plant	Control measures					
Camp Area	Wind breaking wall, water sprinklings,					

dust during construction activities	RMC	Cartilage filters, screw conveyors, bucket elevator	
	CRM	Covered Belt conveyor, Sprinklers, pug mill covers with acoustic support	
	ASPHALT Plant	Bag house, canopy for belt conveyors, spill control kits, secondary containments	
Above air pollution control measures will be implemented for dust suppression during construction phase to avoid air pollution.			

Table 3.3: Social Impacts and their Significance

Chapter-4:

Description of proposed environmental management and mitigation measures

This chapter presents the proposed Environmental Management plan and implementation of mitigation measures on respective environmental and social impacts may occur on setting up the camp area (Plant setup area).

4.1. Mitigation Measure to prevent impact on water environment:

Ground water contamination will be minimized by implementation of a proposed Spill Prevention and Contingency Plan. This plan gives detail measures which will be implemented to prevent spills of fuels, oils, or other contaminants.

Implementation of these mitigation measures will result in low residual impacts (short-term, low severity, local extent).

Mitigation measures will include the following:

- Proper disposal of sludge (i.e., in a secure landfill); Storm water runoff from developed areas will be channeled through several oil-water separators prior to discharge to ground and surface water;
- Placing solid waste into garbage bins with cover.
- Using of trays to collect oil spillage near workshop, Oil storage room.
- Ensure adequate drainage around camp sites
- Ensure fuel and other chemicals are stored as recommended by Environmental Protection Hazardous Waste (Regulations) 2000
- Ensure workshop area is covered so as to prevent storm water/runoff being contaminated
- Ensure grey water from the washroom is discharged via a soak-away system
- No dumping of solid waste into water bodies should be allowed
- Care should be taken to ensure that downstream sedimentation during construction is minimized and temporary water crossing are to be decommissioned after their period of usages to ensure that they do not collapse and block stream flow.
- Removal of soil vegetative cover should be kept at a minimum and should only be carried out with absolute necessity
- To avoid oil contaminants into water bodies, a system for the proper collection and disposal of lubricants at both site and maintenance depot should be maintained;
- In the absence of a sewage system, portable toilets located far away from groundwater aquifers; and

Implementation of these mitigation measures will result in low impacts (short-term, low severity, local extent).

4.1.2 Monitoring

The following four types of monitoring will be employed

- **Inspections** planned and conducted on a regular basis to ensure that mitigation

measures and commitments are properly maintained and implemented, and that specific management procedures are being followed.

- **Receptor monitoring** undertaken to confirm that activities at the site are not resulting in an unacceptable deterioration in the quality of habitats or infrastructure.
- **Compliance monitoring** involving periodic sampling or continuous recording of specific environmental quality indicators or discharge levels to ensure compliance of discharges and emissions with project standards.
- **Auditing (internal and external)** to assess compliance of the project activities with both regulatory and site management system requirements

The outputs from monitoring will be used in the following ways:

- To provide early warning for asset/ site management, to assess mitigation measures on a day to day basis to suit evolving conditions.
- To enable the consultants and the contractors to demonstrate that mitigation measures and procedures laid down in mitigation plans are being followed and operations are being conducted within compliance limits.
- To provide formal assurance to the EPA and other regulatory authorities that the project is compliant with regulations and agreed limits and that relevant mitigation/enhancement measures are being adhered to

4.1.3 Fuel storage / Oil Management

Spills of fuel oil could result in surface and groundwater contamination. Fuel oil storage areas will be located well away from areas of fire hazard and all fuel will be barged and/or trucked to site by secure fuel trucks and transferred into fuel storage tanks that are founded on impervious concrete surfaces. The fuel tanks will be housed within banded enclosures. The enclosures will be sized to retain the contents of 120% of the largest tank in the event of tank failure. Discharge from fuel storage areas will be channeled to oil water separators prior to being discharged to surface water.

Indiscriminate dumping of waste oil will not be permitted under any circumstances. Waste oil will be stored in approved containers, under a secondary containment to deal effectively with any leakage or spillage, before disposal via a recommended method, and/ sold to oil companies. Liquids, spent oils, fuels and lubricants will be collected and returned in drums to oil companies

4.1.4 Spill Contingency Plan

Emergency Response Plan (ERP) and the Spill Prevention and Cleanup Control (SPCC) Plan will be formulated and the elements of each plan are detailed below;

4.1.4a Emergency Response Plans

The objective of the Emergency Response Plan (ERP) is the protection of the communities and the environment in the project area of influence through the development of emergency response strategies and capabilities. This Emergency Response Plan details measures to respond to potential releases of chemicals, process wastewater, fuel oils and/or other hazardous material. In addition, it details emergency response procedures for potential release of hazardous material which is being transported to the site. Examination of the proposed project has identified several possible scenarios which may require the activation

of emergency response procedure. Emergency response actions will be needed for the following;

- Spills of fuel/oil or other hazardous material during road transport to the site
- Releases of fuel/oil or other hazardous material during unloading and mixing
- Releases of fuel/oil or other hazardous material during fires and explosions and
- Release of fuel/oil or other hazardous material due to pipe, valve and tank ruptures
- Fire of fuel/oil or other hazardous material due to fire source

This ERP describes specific response actions, as appropriate for each emergency situations identified above. The response actions include

- Clearing site personnel from the area of exposure, notification to operational, management and response personnel
- Use of antidotes and first aid measures for chemical exposure
- Control of releases at their source, containment of releases, assessment of the release and mitigation of the releases
- Implementation of measures to prevent reoccurrence of releases.

The Emergency Response Center will be the closest Health Care Centre within the vicinity that is located within the Gysuco compound, about 200 meters north. There will be a primary and alternate Emergency Response Coordinator at the site. The coordinators will have explicit authority to commit the resources necessary to implement the ERP. Emergency response teams would be identified and would be appropriately trained and prepared. After the commencement of construction, this ERP shall be extended to include call-out procedures and 24-hour contact information for the coordinators and response team members.

All personnel involved in hazardous waste management would be trained to recognize and respond to situations which can result in releases to the environment. The training will include;

- Identification of procedures to be followed if a chemical release is discovered, including notification of the appropriate site personnel;
- Measures to assure worker safety, and methods to stop or contain the release, if possible

The following list of equipment and supplies will be provided for response to emergencies

- Earthmoving Equipment
- Mobile Generators
- Sand and Gravel
- Pumps
- Pipes
- Absorbents

The Regional Democratic Council of Region 4 will be notified of the potential problem and will be kept advised of the situation. During these contacts, the agencies will be requested to indicate if there are any immediate actions that can be taken to reduce the risk of the emergency and if necessary, preventative actions will be implemented. An Emergency Response Coordinator will be assigned the task to continuously monitor the situation and to coordinate emergency action if required. If there is a release of fuel oil or other hazardous material, all persons and communities within the vicinity will be notified immediately and

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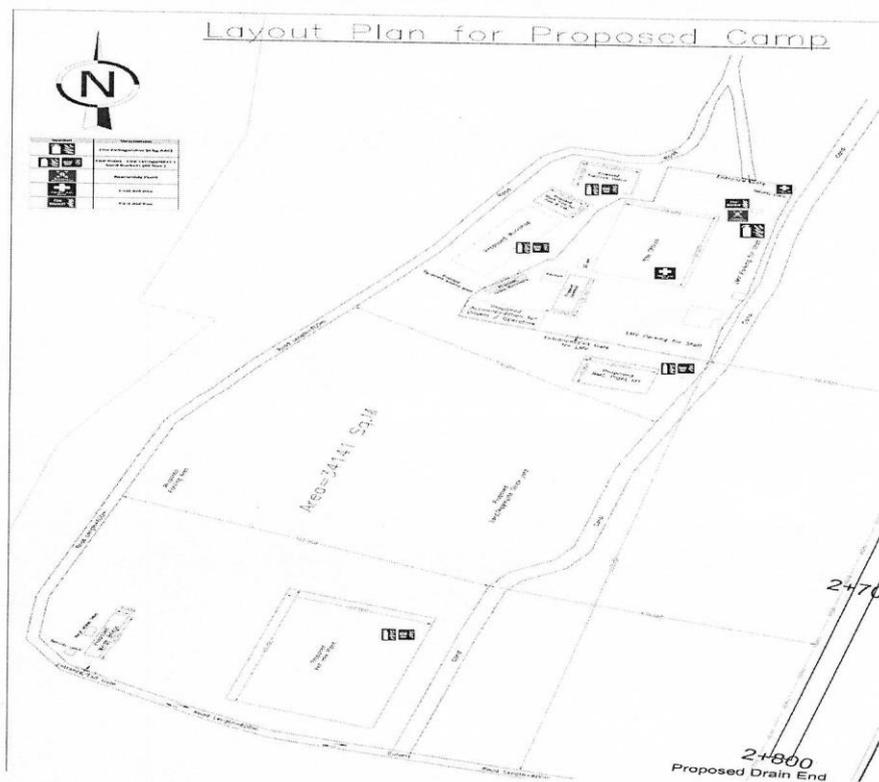
efforts will be coordinated with others to reduce impacts associated with the release. The EPA will be immediately notified.

All transport vehicles will be fitted with absorbent material. If there is a spill/leak of fuel oil or other hazardous material onto roadways during transportation to/from the site, prompt action will be taken to contain the leak or spillage. All combustibles/ignition sources such as running engine, likely to result in fires, will be removed from the vicinity of the spill and anyone in the area will be advised to stay upwind of the spill. Absorbent material in the transport vehicle will be used to cover small spills. The vehicle operator will immediately notify the Contractor which will assign an Emergency Response Coordinator to respond to the emergency. A berm will be constructed around the spill area to control runoff to surface water.

All soils impacted by the spills will be excavated from the spill area and disposed in accordance with the hazardous waste management procedures. In the events of spills to surface waters, fauna will be trapped and will be relocated to areas within proximity of the site, which are the same ecologically as the spill area.

Spills of fuel oil will be responded to by the addition of surfactants and by retrievals with skimmers. Other chemicals, which cannot be recovered manually, chemically or by mechanical means will be allowed to naturally degrade by dilution and dispersion.

Fire control equipment like fire extinguishers, sand buckets etc. will be installed at the camp area by considering the potential fire sources and fire loads.



4.1.4b Spill Prevention and Cleanup Contingency Plan

This Spill Prevention and Cleanup Contingency (SPCC) Plan will become effective coincident with the commencement of construction activities. Emergency Response Coordinators will have authority to expend funds and recruit employees to implement the Spill Prevention and Cleanup Contingency Plan. The SPCC Plan addresses the following

- Operating procedures to prevent oil spills
- Control measures which will be installed to prevent a spill from reaching navigable waters, and
- Countermeasures to contain, clean up, and mitigate the effects of any spill which discharge to surface or ground water

This SPCCP also sets out an organized, planned and coordinated course of action to be followed in case of a fire, explosion, or release of hazardous material which could threaten human health or the environment. The SPCC Plan would be implemented for on-site, as well as off-site releases that could threaten human health and the environment, even if the Emergency Response Coordinator does not believe that the spill will leave the site. The Plan deals with threats to facility personnel, as well as with threats to people outside the facility. Appended to this SPCCP, will be information such as contact list and phone numbers for the Emergency Response Coordinator(s), the EPA, cleanup contractors, and other appropriate national and local agencies who will be contacted in case of a discharge.

Portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment will also be maintained at the project area. All fuel storage areas shall be founded on impervious surface and be sited in containment facilities designed to retain 120% of the tank contents. The containment may be either dikes, berms, retaining walls or curbs. Discharge from the containment area shall be directed into gutters which flow to oil-water separators prior to release to the environment. Water discharges to the environment shall be monitored to ensure adherence to water quality.

If there is a discharge from the fuel storage area to the environment, an Emergency Response Coordinator shall respond to that discharge. Spills of fuel oils will be cleaned by mechanical methods and chemical dispersants. The specific method to be used will depend on the quantity and location of the spill. Mechanical cleanup, using booms and skimmers will be used to recover spills to surface water. Containment booms would be used to control the spread of spilled product and to concentrate the product in thicker surface layers to make recovery easier. In addition, booms will be used to divert and channel oil slicks along desired paths, making them easier to remove from the surface of the water. Skimmers would be used to recover spilled oil from the surface of the water. Skimmers will be either self-propelled or operated from the bank of streams/creeks.

Chemicals dispersants will be used to accelerate the breakup of fuel oil and refined product spills to surface water. Dispersants would be applied immediately following a spill, before the lightest materials in the oil have evaporated. The use of dispersants in freshwater would be authorized by the Emergency Response Coordinator only if it does not pose any threat to human health or the environment. Surface water samples will be recovered from the impacted areas after cleanup to ensure that residual levels of hydrocarbons and other fuel oil constituents do not exceed tolerable limits. If surface water quality has not been water until water in the

affected area again attains acceptable water quality.

The SPCC Plan will be reviewed, and be immediately amended whenever the following situations apply:

- Applicable regulations are revised
- The plan fails in an emergency
- The project changes its design, construction, or other circumstances in a way that materially increases the potential for fires, explosions, or releases
- The list of emergency coordinators changes
- The list of emergency equipment changes

4.2.2 Mitigation Measures to Prevent Impact on Soils, Land and Geology

Soil, land and geology impacts will be mitigated by confining, clearing and excavation activities only to those areas required for the execution of the project. The mitigation measures will result in low impacts (short-term, low severity, local extent).

Appropriate mitigation measures will result in low impacts (short-term, low severity, local extent). The movement of heavy equipment may cause rutting and compaction of susceptible soils. Near-surface soil compaction will reduce the ability of the soil to absorb water. Furthermore, water already in the soil will become more tightly held and, thus, less available to plants and animals. Compaction will also change the variability of soil temperature. This effect would be most apparent near the surface, where the soil becomes hotter during the day and colder at night.

The following mitigation measures should be implemented to reduce the impact of erosion and sedimentation activities.

- ◆ Minimize the removal of vegetation to areas where it is absolutely necessary
- ◆ Encourage natural re-vegetation in areas where possible to prevent soil exposure
- ◆ Monitor areas of exposed soil during periods of heavy rainfall
- ◆ Slopes should be constructed at the recommended angle to prevent collapse
- ◆ No harvesting should be done on slopes greater than 40%.
- ◆ Use appropriate machines for all earthworks
- ◆ Designate routes of heavy-duty equipment to prevent compaction of soil.
- ◆ Avoid discharging of storm water runoff directly into the nearby watercourses. This discharged can be channeled through the vegetative area which will serve as a natural filter for any sediment contained
- ◆ If ponding is observed due to compaction, it may be necessary to scarify the topsoil. Consider the weather pattern before initiating major earthworks. Earthworks should be avoided during periods of heavy rainfall
- ◆ Raising low spots on the embankments
- ◆ Routine inspection of dams and structures

4.2.3 Air Environment:

Production of construction materials works will result in emissions of fugitive dust and products of combustion. Dust generated would be a function of construction activities, soil type, and moisture content, and wind speed, frequency of precipitation. Dust is broadly defined as small solid particles created by the break-up of larger particles. Depending on their size, dust particles can become hazardous to worker health, particularly when suspended in the air. The largest size particle that can be suspended in the air for long periods of time from wind velocity acting upon it is about 60 micrometers (μm), which is about the thickness of a human hair.

Products of combustion will include Benzene, PM10, PM2.5, carbon monoxide, NO_x, SO₂, VOCs –a precursor of ozone and hydrocarbons. Ozone, sulfur dioxide, fine particulates, and nitrogen dioxide have both acute and chronic health effects. Carbon monoxide has acute effects only, whereas lead, being a toxic metal, has chronic effects (at ambient air levels). Ozone is a strong oxidizer that affects the respiratory system and may lead to damage to lung tissues. Its acute effects include cough and chest pain, eye irritation, headaches, lung function losses, and asthma attacks. The acute effects of sulfur dioxide include irritation and restriction of air passages. There is reduced mucus clearance from the restricted air passages and chest tightness. Under normal conditions, the lung passages are open, however, the lung passages constrict in a response to SO₂. This constriction further aggravates other health conditions. Sulfur dioxide also causes immune system suppression and increases the probability of bronchitis. There are some indications that chronic exposure to sulfur dioxide may also act as a cancer promoter in addition to an immune system suppressor.

Exposure to elevated concentrations of fine particulates increases mortality rate, increases the incidence of asthma and bronchitis, and rates of infection in the respiratory system. Particulates also directly irritate the respiratory tract, constrict airways, and interfere with the mucous lining of the lung passages. The chronic effects of fine particulates include loss of lung capacity and lung damage, resulting from scarring caused when fine particulates are not cleared from the lung passages or alveoli. Fine particulates also act as carriers for toxic contaminants and heavy metals particularly when the contaminants exist in a fume or a vapor state and condense onto the fine particulates. In the alveolar regions, heavy metals may be absorbed into the blood and circulated to other parts of the body. Particulates and fine particulate fractions are also responsible for visibility reduction.

Stripping topsoil and overburden will generate dust when undertaken in the dry season. Dust emissions from Hot mix plant asphalt plant and milling equipment, material stockpiles, and other fugitive dust-generating operations would occur over the duration of the operation. This will result in moderate impacts (medium-term, moderate severity, local extent).

3.2.4 Noise Environment:

Impact Prediction and Assessment

Production of construction material activities will produce noise levels above the WHO industrial/commercial noise level guideline value of 70 decibels (dBA) from Hot mix plants and Ready mix concrete plant. Maintenance operations in workshops will generate noise levels about 72-110 dBA. Noise levels from the power generation plant will range from 90-105 dBA. Exposure to noise levels above 90dBA can cause noise-induced hearing loss. Noise levels above the tolerable threshold of 72 decibels may result in fatigue, tiredness, low morale and decreased production levels. Primary noise receptors in the area will be individuals involved in construction activities at the site. There are several communities close to the project boundaries.

Tired workers are prone to accident which may contribute to an increase in work-related accidents. These are high impacts (medium-term, high severity, local extent).

Construction phase noise will have an adverse effect on many species of wildlife that are

- ◆ Installation of soil berms as noise barriers to mitigate noise impacts adjacent to work site areas;
- ◆ Installation of sound suppression devices (such as mufflers) on earthmoving equipment generators, etc.;
- ◆ Avoiding unnecessary idling of vehicles and machinery that are used intermittently
- ◆ Employing the best available work practices on-site to minimize occupational noise levels and
- ◆ Provide personal protective equipment (PPE) to employees and contractors and requiring their usage under the health and safety plan

Implementation of these measures would result in low residual impacts (short-term, low severity, local extent).

A nuisance to nearby properties is likely to result from

- ◆ Noise and vibration from Diesel generator
- ◆ Dust during Hot mix plant, Crusher Run Macadam and Ready Mix plant production
- ◆ Gaseous emissions from heavy equipment;
- ◆ Fumes from asphalt boiling sites.

Noise is expected to be a significant environmental impact that requires mitigation, especially to reduce the impacts on workers. Appropriate mitigation measure will be implemented to reduce impact on noise environment.

4.4 The trans-frontier nature of impact:

Study area does not cross the country borders.

4.5 The magnitude and complexity of the impacts:

Impact magnitude measures the severity of environmental effects. Effects range from minor or inconsequential with little significance to major or catastrophic with significant adverse environmental effects which may be unacceptable. When considering the magnitude of potential impacts, the development was considered within the context of regional development and the extent to which the project could trigger or contribute to any cumulative effects.

4.6 Probability of impacts:

In this ESIA, likelihood, is defined as the probability of an impact occurring. Two criteria are considered when examining likelihood: (1) probability of occurrence: if there is a high, medium or low probability that a particularly significant environmental impact will occur, (2) the certainty of significance: the level of uncertainty associated with the environmental assessment, often termed as 'confidence limit'. If confidence limits are high and impacts are evaluated as significant, there is a high degree of certainty that the conclusions are accurate and environmental impacts are significant. If confidence limits are low, there is a high degree of uncertainty about the accuracy of conclusions, and it will be difficult to decide whether significant environmental effects are likely or not.

4.7 Duration, frequency and reversibility of impacts:

Reversibility, in this ESIA, refers to the environmental recovery once an impact has occurred. Irreversible environmental impacts are commonly considered more significant than those that are reversible. Irreversible changes always command attention because they signal a loss of future options.

Duration, within this ESIA, considers the period over which an environmental effect occurs. Long-term environmental effects may be significant. Short-term environmental effects may also be significant, especially if the short-term effects negatively affect public perception of a project. Frequency is closely related to the duration of the environmental effect. The frequency of effects and the potential of the environment to recover from these effects are important. If an activity is intermittent, for example, it may allow for environmental recovery during inactive periods.

4.8 Cumulative Impacts

Cumulative impacts are mostly indirect and defined as incremental environmental changes caused by independent or repetitive activities. These impacts may occur as interactions between activities, between an activity and the environment, and across environment media. Cumulative effects can occur in many ways including (CEAA 2003; Spalding 1994).

A physical or chemical constituent can be transported away from the impact source only to interact with another activity or environmental medium (e.g. soil erosion or acid rock drain-age) The gradual disturbance and loss of land and habitat, or nibbling loss (e.g. incremental land clearing as the mine advances or incremental road development into forest areas, alienating wildlife habitat due to sensory disturbances).

The study area is accompanied by an airport, a sugar factory, and other industry. There isn't a chance that nearby businesses would be negatively impacted, but once the road constructions are finished, current businesses will have improved connectivity, which is good for them.

Spatial and temporal crowding, when too much is happening within too small an area and/or in too brief a period. Spatial crowding includes overlapping effects from separate activities (e.g. downstream confluence of effluent plumes from multiple discharge points). Temporal crowding occurs when impacts from different actions overlap or occur before the receiving environment has had time to recover (e.g. family stress due to continuous fly-in/fly-out employment).

Each impact can induce further effects, sometimes called growth-inducing potential. The effects of these spin-off impacts (e.g. increase in hunting or trade of endangered species due to improved access to areas) may add to the cumulative effects near the mine. The magnitude of cumulative effects, or the impact propagation between causes and effects, can equal the sum of each individual effect (additive effects) or can result in an increased effect (synergistic effect). There are many other examples of cumulative impacts; incremental noise from independent activities (either from one or several projects) or the cumulative effect of individual impacts on a receptor, such as human stress due to combined noise and dust exposure, or visual impacts. Impact interactions, a subset of cumulative impacts, can occur either between the impacts of one project or between the impacts of several projects

The opposite cumulative impacts are cancelling, offsetting or compensating impacts. These are also quite common. Examples include water abstraction that is offset by water discharges or increases in traffic offset by improvements in capacity of local roads. The objective is to generate impacts that will offset the significant adverse impacts.

Monitoring Plan

1. We will review the pollution control equipment and its effective use on every quarter, if there are gaps in maintenance of dust collectors, bag house will be restored with immediate effect.
2. Monthly Review of maintenance of settling tanks, waste collection bins, recharge pits for effective management.
3. Monthly review of Noise control equipment like acoustic enclosures and maintenance of equipment, plant parts will be performed.

- 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 project influence area begins at Ogle and terminates at Great Diamond. It also encompasses Georgetown and the East Bank of Demerara via the connector roads

5.2 Stakeholder Analysis

Public meetings were organized with the residents of the surrounding areas at North Ruimveldt School, Ogle Community Centre, Grove/Diamond Secondary School and Better Hope Community Centre where the project was discussed and further views sought. During the initial reconnaissance conducted the residents and the general public all support the project and are waiting eagerly for its commencement and full implementation. Those that attended the meeting included:

- Traders along the road-green grocers, salon attendants
- Drivers of vehicles along the road
- Businessmen and women - for businesses along the road to be constructed butchery, furniture, welding, masonry, etc.
- Residents owning properties along the road to be constructed

The ESIA consultations included disclosure of the design and project status that was done by RITES Limited.



Chapter-6

Description of any assumptions, uncertainties and gaps in knowledge

The road project activities are involved following assumptions and uncertainties:

Aspect	Performance Objective	Assumptions / Goals	Controls
Air Emission /Air Quality	To maintain air quality, to minimize the potential impact of construction related air emissions, including dust, on site or adjacent Communities	No complaints received from neighboring communities relating to air quality and related to site activities. No adverse irreversible impacts on site values. No impacts on staff/worker health	The Contractors shall be required to identify and implement an Air Emissions and Air Quality Management measures to ensure compliance with these objectives and goals
Water Discharges	- Minimize the impact of water movement on and off site and its associated erosions, sedimentation and potential pollution effects	No extended or unmanaged areas of erosion on-site, and any sediment deposition or run-off across or from the site. No discharge of sediment No discharges to roadways of private property No modification to the existing drainage patterns No uncontrolled storm water discharges or discharges from dewatering of excavations No pollution incidents.	The Contractors shall be required to identify and implement site specific Water Discharge Management measures to ensure compliance with these objectives and goals.
Noise and Vibration	To provide a safe working environment for workers To minimize disruption/impacts due to general public and property elevated noise and vibrations	No complaints from residents about noise or vibrations Informed public about potential noise levels and mitigation efforts No noise levels above EPA standards	The Contractors shall be required to submit a Noise and Vibration Management measures to ensure compliance with these objectives and goals.
Traffic and vehicle movement	To provide a safe working environment and minimize disruption/impacts to the local traffic, neighbors and the public. To ensure no traffic impacts on, fenced or environmentally sensitive areas To ensure that the community is informed	No extended or unannounced disturbance to local traffic, neighbors and the public. No unauthorized parking No traffic accidents associated with project vehicles or use of local roads and highways. No vehicle or machinery impacts on environmentally sensitive areas No storage of vehicles and material on roads	The Contractors shall be required to submit a Traffic Control Management Plan to ensure compliance with these objectives and goals.

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	of all changes or planned disruption of local and highway traffic		
Materials and Construction Wastes	Effective Storage and handling of materials Maximize reuse of materials	No evidence of site contamination as the result of waste. No waste disposal infringements No residual materials after use of storage locations No disposal of useful materials	The Contractors shall be required to submit a Construction Materials and WasteManagement Plan to ensure compliance with these objectives and goals

Annexure

- 1. Ready Mix Concrete – Feasibility report**
- 2. Crusher Run Macadam Plant – Feasibility report**
- 3. Hot Mix Plant – Feasibility report**

