

ALYA Construtora S.A.

Linden to Mabura Hill Road Upgrade

(Project Summary)



2023

1. Contract Administration

1.1. Project Information

Name of the Project: Linden to Mabura Hill Road Upgrade

Name of the Client: Ministry of Public Works

Name of the developer: ÁLYA Construtora S.A

Contact details:

- Mr. Pedro Paulo Tosca, ALYA Construtora S.A Project Manager (Phone: 632 1391)
- Mr. Gibran Ferreira ALYA Construtora S.A Sustainability Manager (Phone 600 3634)

Address: Lot 38 Croal Street, Stabroek, Georgetown

Type of Project: Road Construction

Location: The project is in Administrative Region #10: Upper Demerara – Upper Berbice.



2. Key information

2.1. Location

The LMH Road – This road, approximately 121 km in length, commences in the town of Linden and ends at Mabura Hill. This road is part of a critical road network linking coastal regions (including the capital city of Georgetown) with Regions 7, 8, 9 and 10. The LMH Road is the sole means of directly accessing the Mile #47 and Mile # 58 villages which are located along the road corridor. The roadway and Kurupukari crossing provide a cost-effective means of travel to Mahdia (Region 8), the Fairview Village, IIC and the Rupununi regions and northern Brazil as compared with air travel. As a consequence, significant quantities of freight are transported using the project sites with food and fuel being transported inland and forest produce such as logs and lumber being transported out. Finally, the Rockstone Junction, located along the LMH road connects to one of the main road networks leading to Region 7.

A 2.5 km section at the start of the LMH road has been surfaced with a Double Bituminous Surface Treatment (DBST) but is showing signs of distress. The remainder of the road corridor is unpaved with a laterite surface.

In addition, in some sections, the road is constructed on white sand which is highly susceptible to erosion. The existing road has limited drainage system and rainwater runs off the surface of the road. At some sections of the road, makeshift turnout drains have been created and some of these drains are significantly eroded. At other sections of the road, pits have been dug on the land at either side into which water drains. At several locations, runoff has led to the formation of gullies which erode the road edge and increase the risk of washouts if not repaired and maintained. Currently, there are five crossings along the alignment at Ch 72+750 (Mile 40), Ch 75+550 (Mile 41), Ch 85+720 (Cassandra Crossing), Ch 87+080 (Mile 47) and Ch 115+240 (a log bridge).

There are also four small culverts that provide surface drainage locally to the road e.g. to drain small cuttings.

These small culverts are located at chainage 98+900, 99+610, 99+960, and 100+170 respectively. During the dry seasons, there are significant emissions of dust when vehicles traverse the road. Sections of the road occasionally become impassable during the rainy season due to inadequate roadside drainage and

limited maintenance.



Figure 1: Project location map in relation to the wider Linden to Lethem Road

2.2. Geology

2.2.1. Physical Setting

Guyana is located on the eastern end of the Amazon Basin and is bordered by Venezuela to the west, Suriname to the east and Brazil to the South. When

completed, the upgrade of the LMH road and the construction of a crossing at Kurupukari will improve the critical north-south link between the hinterland and the coastal belt, enhancing access to the seaport at Georgetown and the town of Lethem by the border with Brazil. Due to the length of the alignment, the Georgetown to Lethem road will pass through a range of physical settings. Major works on the LMH section of the alignment commenced more than 50 years ago. In 1979, the Ministry of Works and Hydraulics, with assistance of the CDB, completed construction of an all-weather laterite road with timber bridges on a 112.7km section of the road from LMH. In the early 1990s, the entirety of the 125 km road between Linden and Mabura Hill was rebuilt by Omai Gold Mines Ltd. The LMH road is located on the watershed between the Demerara and Essequibo Rivers. Mile 0 starts in Wismar, Linden (approximately 105 km from Georgetown) and ends at Mabura Hill covering 125km. The town of Linden is the largest settlement which directly interacts with the road at its starting point. Settlements along the alignment are sparse with small communities located at the Mile #47 and Mile #58 villages. The Mabura Hill community is located at the end of the alignment and was built around DTL logging company.

2.2.2. Geomorphology and Soils

Guyana is located on the northeast coast of South America and most of its geological formations is comprised or underlain by rocks which date back to the Precambrian period. Geological formations are part of the Precambrian Guiana Shield which lies between the Orinoco and Amazon Rivers and encompasses all or portions of neighbouring countries Suriname, French Guiana, Venezuela, Brazil and Columbia, aggregating to an area of 1.6 million km².

From Linden to Mabura Hill, the existing road mainly traverses white and brown sands underlain by younger granites, metabasic dykes, sills and flows. Faulting is much more prevalent in this section with most faults trending north-west to south-east²⁵. Further, the LMH Road traverses one of five recognised physiographic units of Guyana, the white sand plateau. The white sand plateau is composed of pliocene and pleistocene deltaic deposits of sands and clays interbedded with kaolinite clay and bauxite with higher elevations towards the south of Guyana.

The surface is composed of a combination of white quartz sand ('White Sands') which covers much of the area between Linden and Kurupukari²⁶.

According to a Land Capability Map prepared by the Guyana Lands and Surveys Commission (GLSC), most of the soils along the LMH road are classified as Category III or IV. The Category III soils are generally poor for agricultural purposes and often require fertilization to cultivate crops. These soils occur in both savannah and forest areas and are of variable depth, drainage, colour and texture which have developed mainly in transported materials and areas of low natural fertility, mainly undulating and gently undulating upland and terrace sites. Soils classified as IV are non-agricultural soils encountered in savannah and forest. These soils are shallow lateritic gravels soils and are encountered on mountains and hill lithosols and in areas of deep sterile excessively drained sands. However, there are a few isolated areas along the road in the vicinity of Linden, Mile #47 and Mile 57 villages where soils may be classified as Categories I or II which are considered good for agricultural purposes²⁷. The soils in the project area are shown in Figure 2.

In addition, the White Sands Plateau is comprised of two types of sand: white sands which extends to the Essequibo River and covers the majority of the area, and brown sands which is interspersed in pockets. The white and brown sands have a very low fertility, low pH, low cation exchange capacity and drainage ranges from excessively drained (albic Arenosols) to poorly drained floodplains (gleyic Cambisols)²⁸.

The existing LMH Road has no drainage system and rainwater runs off the surface of the road. At some sections of the road makeshift turnout drains have been created and some of these drains have significantly eroded. At other sections of the road, pits have been dug on the land at either side into which water drains. At several locations, runoff has led to the formation of gullies which eroded the road edge. It is anticipated that much of the road upgrade will be constructed within the existing road corridor; however, some vegetation clearance will be required to accommodate the proposed road and utility corridor.

Geotechnical and pavement investigations were undertaken in 2019 as part of the feasibility study which indicate the ground along the LMH roadway is as follows: Linden to Mabura Hill

- 0.1 to 0.4m thickness of either dark brownish red, stiff to very stiff, slightly sandy, gravelly clay laterite made ground, or, dark brownish red, stiff, very sandy, slightly gravelly clay laterite made ground; overlying;
- 4m to 8m of very loose and loose, whitish grey, gravelly sand. Sand is medium and coarse, high sphericity, subangular. Gravel is fine to medium, angular to sub-angular of various lithologies; overlying (where present);
- 2m to 8m of spongy to firm, dark brown and black, sandy fibrous peat; overlying;
- 2 to 8m of firm to stiff, greyish white, slightly sandy, gravelly clay; variably loose, greyish white, slightly clayey sand. Gravel is fine to medium, angular to sub-angular. Sand is fine; overlying;
- 1m+ proven of green and white, extremely weak, very thinly bedded, de-structured bedrock.

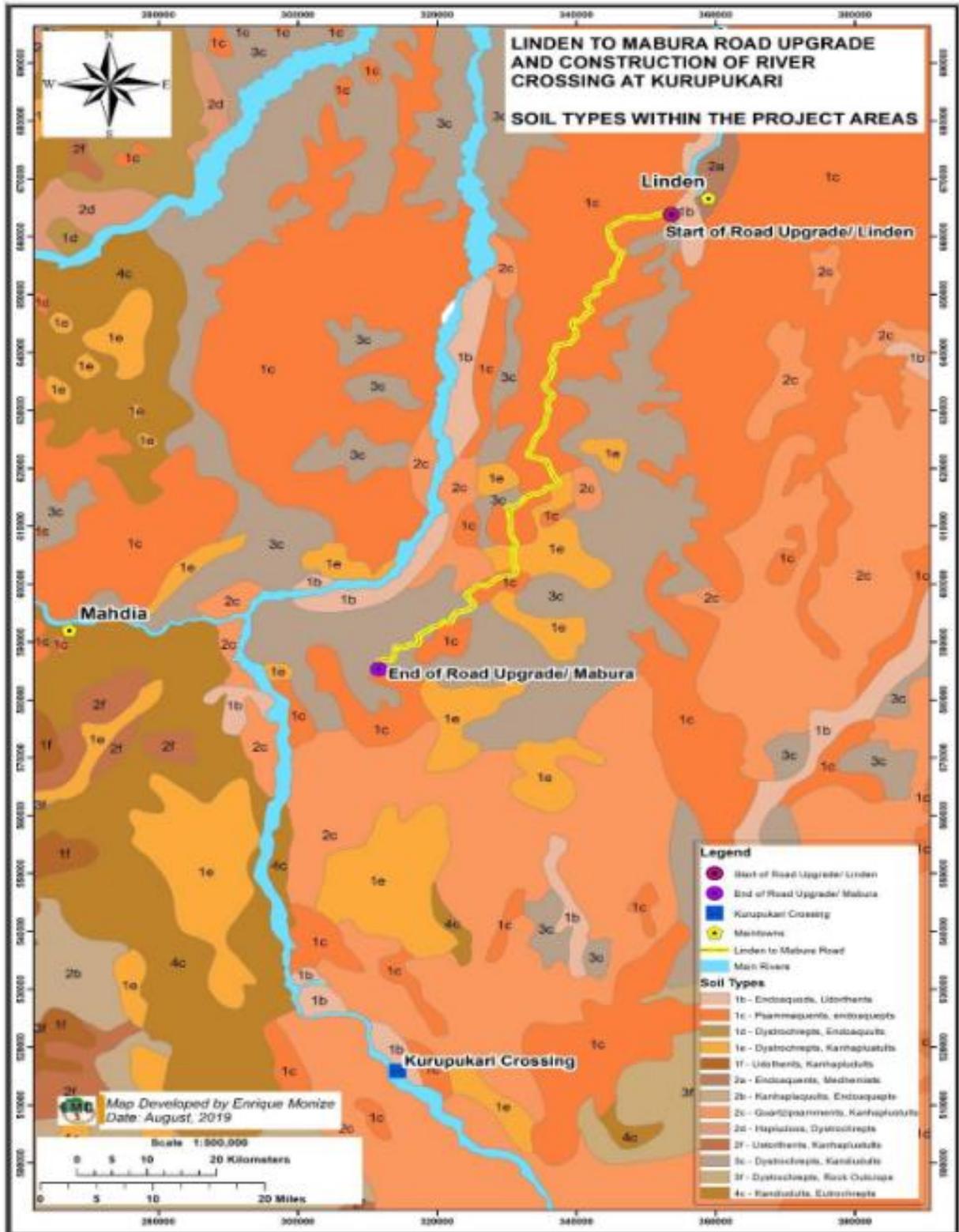


Figure 2: Soil Types at the Project Areas.

2.2.3. Topography

The existing LMH road follows the watershed between the Essequibo and Demerara Rivers and closely follows the route of the Essequibo River. 30 According to the topographical map of Guyana, there is some variation in topography of the route but it is mainly flat to rolling. However, hilly terrain and higher elevations occur between Mile #58 village and Mabura Hill.

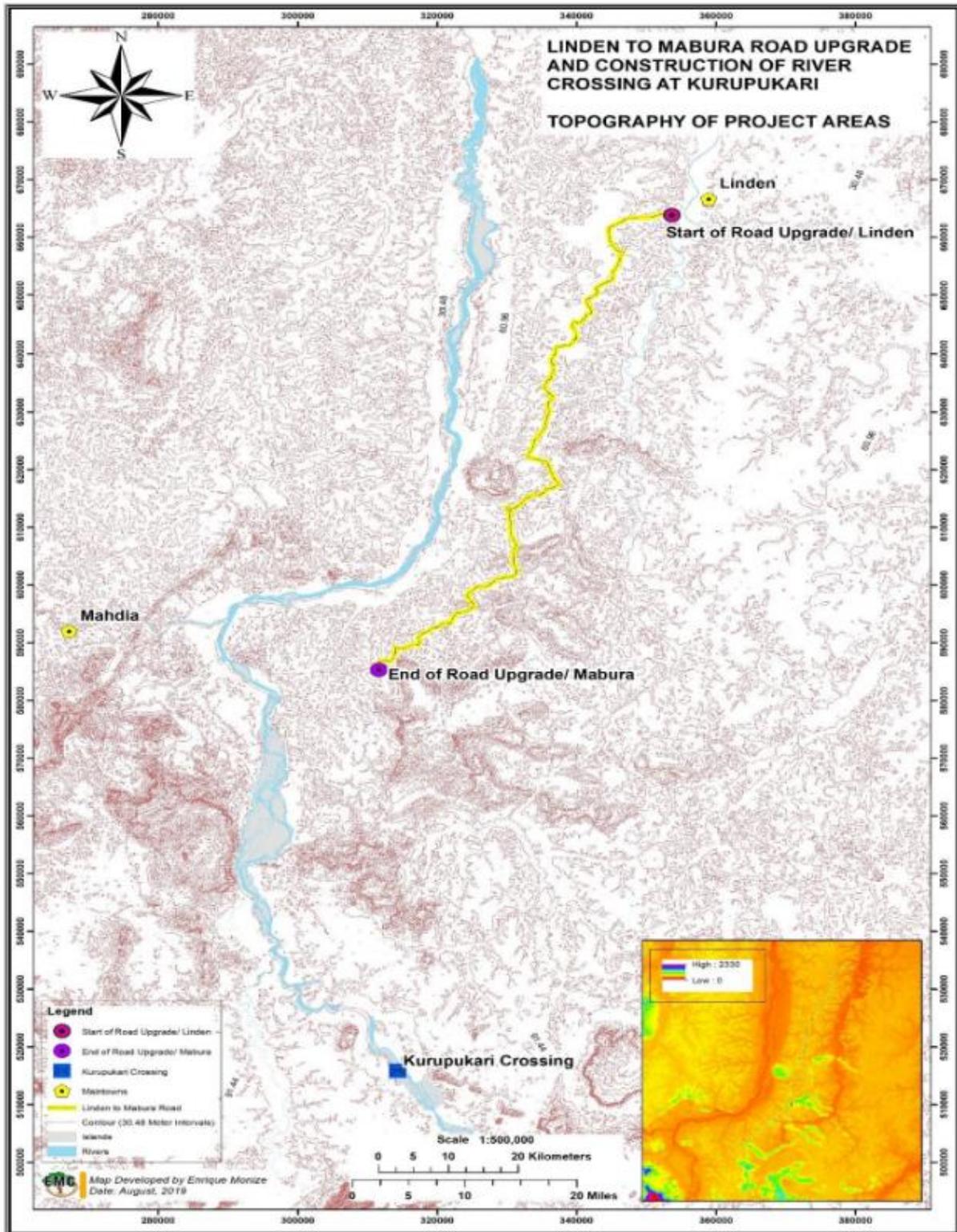


Figure 3: Topography of the Project Areas.

2.3. Climate

Guyana is located in the equatorial trough zone and has a wet tropical climate characterized by warm temperatures and abundant precipitation. Air temperatures

range between 16°C and 34°C with the lower range of temperatures being observed in higher regions. The primary factor influencing Guyana's climate and particularly its precipitation patterns is the Inter-Tropical Convergence Zone (ITCZ), a cloud and rain-bearing belt of rising air where south-easterly and north-easterly trade winds converge. Most places in Guyana experience a bimodal annual cycle of rainfall with distinct wet seasons. The first rainy season is the primary wet season and extends from mid-April to the end of July and the secondary wet season occurs from mid-November to January. The periods in between are often referred to as primary dry (long) season and secondary (short) dry season respectively. However, rainfall can occur at any time. A unimodal annual wet cycle (mid-April to August) is observed over the southernmost part of Guyana – the Rupununi Savannahs.

The LMH Road falls within one of three climatic zones in Guyana and which is the wet/dry tropical forests characterised by hotter days, cooler nights and annual precipitation between 1,778 mm and 2,800 mm.

There is no weather station operated by the Hydrometeorological Department of the Ministry of Agriculture along the road alignment or at the Kurupukari Crossing. Alternatively, data was utilized from weather stations located in Georgetown near the coast; Timehri located inland to the north of Linden as well as three stations located towards the south-west of the country, namely Annai, Surama and Lethem. The two northern stations provide between 50 and 60 years of continuous records which are likely to provide better estimates of longterm trends. Among the southern stations, only Lethem is associated with a 20-year series of continuous data.

2.4. Design

This project consists of upgrading 121.2km of existing road between Linden and Mabura Hill. The proposed road has been designed to a design speed of 80kph with a posted speed of 70kph. Design and posted speeds for sections which pass through the villages are lower at 60kph and 50kph respectively. Similarly, at some tight bends along the roadway the design and posted speeds are lower. The roadway will generally have a width of 13.2m, consisting of a 7.2m carriageway (two 3.6m lanes) plus a 2.4m hard shoulder and a 0.6m verge either side of the

carriageway. At village locations the road will be slightly wider with a 0.4m hardstrip, a 1.0m raised separation island, and a 2.0m footway and 0.6m verge either side of the 7.2m carriageway.

Carriageway widening will be required on tight bends to allow vehicles to safely negotiate the turn and verge widening will be required in places to achieve visibility or accommodate a safety barrier, meaning that there are many locations where the proposed road is wider than 13.2m. The existing LMH Road is generally wide, mostly measuring between 13m and 15m and extending up to 20m in places. This is expected to allow space for much of the road upgrade to be constructed within the existing road footprint, however vegetation clearance will be required in places to allow for construction of the drainage ditches and the provision of a 2.5m wide utility corridor on the right hand side of the road. Please see Figure 2 and Figure 3 for the typical design cross sections.

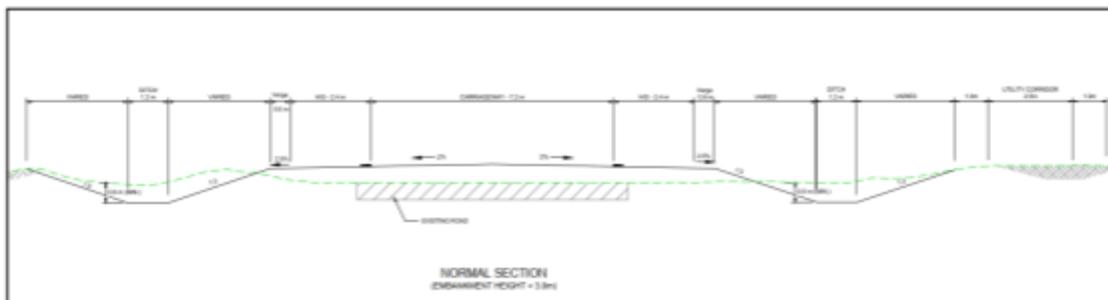


Figure 2: Normal Section of Road Design



Figure 3: Village Section of the Road Design

2.5. Drainage

The poor condition of the existing road can largely be attributed to poor drainage leading to water pooling on the road and the road surface deteriorating. The proposed design includes the following measures to address this:

- The new road will be built up so that it is higher than the surrounding ground

- A 2% cross-fall and minimum longitudinal gradient of 0.3% will be provided to allow water to drain from the road surface
- Trapezoidal drainage ditches with a base width of 1.2m will be provided with an effective depth of 0.6m (including freeboard allowance). These have been sized to collect runoff generated over the driving lane (i.e. 3.6m width), hard shoulder, drain footprint, and the adjacent utility corridor and are based on 1 in 5-year design flow + mid-century climate change allowance
- Each road drain will be provided with a channel outlet or “turnout” at regular intervals, including its downstream extremity, to discharge runoff back to the environment in a controlled way.
- Drainage Ditch Lining – Lining protection is to be provided along the majority of the drainage ditches to prevent erosion/scour. Drainage ditches with a gradient above 1% will be lined with a 3D cellular confinement system (also known as geocell) comprising a permeable geotextile fabric formed in a honeycomb-like structure, which has already been used in Guyana, that can be infilled with readily available white sand before the system is overlaid with 50mm of black sand which then vegetates naturally. Drainage ditches with a gradient of less than 1% will not be lined as grass cover to ditches is considered adequate to prevent erosion.
- In locations where the longitudinal gradient of the drainage ditch exceeds 5%, a geosynthetic cementitious composite mat (GCCM) will be provided to prevent erosion. This is a flexible, concrete filled geosynthetic, which hardens on hydration to form a thin, durable concrete lining. At embankment locations where there is high erosion risk, concrete kerbs and drainage chutes will be provided to channel water from the road.

These embankments will be protected at the base to prevent erosion.

2.6. Pavement

The project aims to improve the alignment and upgrade the pavement to an all-weather surface using asphalt concrete (AC). The design is required to be functional for the 20-year projected traffic and be one which will lend itself to staged construction in line with the addendum to the TOR dated 15 October 2020. This will be achieved by initially constructing a 110mm AC surface to be open to

traffic in 2024, before being overlaid with an additional 50mm of AC in 2034. Please refer to Figure 4 for the initial design with a 110mm AC surface.

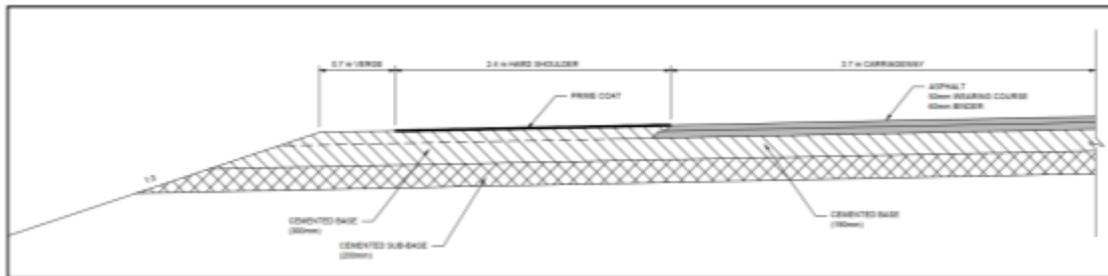


Figure 4: Cross Section Design

The below design principles have been applied to produce this design:

- Retention of the existing structure. The existing pavement structure comprises lateritic gravel, loam and sand which are to be retained or recycled, as far as is practicable.
- Maximising the use of locally sourced materials to limit import requirements. Borrow pits have been identified along the route containing laterite, loam and white sand. Additionally, igneous rock sources have been identified within proximity of the route. Laboratory tests commissioned during the feasibility stage have allowed the suitability of these materials for use within the pavement to be assessed.

2.7. Environmental Baseline Survey Prior to Commencement of Construction

The activities to be conducted for the implementation of this project, especially during the construction phase, must be carried out in a manner that follows the legislation and guidelines outlined in the contract documents including the Management Strategy and Implementation Plans (MSIP). In consideration of this, an Environmental Baseline will:

- Recognise the current state of the conditions existing prior to development for which, subsequent changes, if any, can be referenced.
- Guide the project's activity by setting out measures and strategies to address the environmental issues related to the upgrade of the road.
- Ensure regulatory requirements are met and that impacts do not exceed standards stipulated in the contract documents.

The Plan will be modified and updated as the project develops and in response to the outcomes of monitoring activities and in collaboration with stakeholders as new issues arise.

2.7.1. Data Acquisition

Monitoring will be carried out by an approved Environmental Consulting Firm and any other qualified personnel provided by the Contractor. Compliance monitoring will be conducted which involves periodic sampling or continuous recording of specific environmental quality indicators or discharge levels to ensure compliance of discharges and emissions with project standards. The parameters specific to this project, as stipulated in the MSIPs, are as follows:

Water	Air	Noise
Temperature	Ease of visibility	Threshold measurements (decibels)
pH	Suspended particles	
Turbidity	Particulate matter	
Oils / Grease		
Dissolved Oxygen		

2.7.2. The Environmental Protection Regulations 2000 (Air Quality)

The Environmental Protection Regulations, made under the Environmental Protection Act, were gazetted in 2000. These Regulations provide rules for the reduction and prevention of air pollution in Guyana. Any person who emits air contaminants shall register with the Environmental Protection Agency and a person who emits any air contaminant in the construction, installation, operation, modification, or extension of any facility relating to: (a) industry; (b) commerce; (c) agriculture; or (d) any institution, shall apply to the Agency for an environmental authorisation. The Agency shall establish the parameter limits with respect to any of the contaminants specified in the First Schedule.

2.7.2.1. Dust

The project has the potential to generate dust at levels which can significantly affect the air quality within

the immediate project area. The existing roadway surface (laterite) is unpaved which is a factor that can significantly increase dust generation, especially in prolonged dry periods. Dust will also be generated from several aspects of construction including:

- a) Particulate matter from vehicles transporting aggregates, loading and off-loading of trucks, and excavation activities
- b) Particulate matter from construction and operation of support facilities such as material stockpiles area, cement stabilisation activities, and asphalt production.
- c) Exposed roadway surface becoming airborne from vehicular traffic on roadway corridor within the construction zone, especially during the dry seasons.

2.7.2.2. Potential Impacts

Dust generation impacts have the potential to negatively affect residents of the settlements proximate to the project sites and possibly tourism activities within communities. Dust generation would be greater during dry periods and will be influenced by construction activities, soil type, moisture content, and wind speed. Dust can also be generated from material stockpiles because of wind, especially during dry conditions. During cement stabilization, workers can be exposed to prolonged dust pollution which can develop acute respiratory ailments and eye irritations. Dust emissions may also impair the line of sight of workers and road users which increases the possibility of vehicle accidents and other safety concerns.

The associated impacts, even though localized, shall be mitigated to reduce the effect on the environment.

2.7.3. Air Quality Monitoring Framework

Air quality monitoring will be conducted at all active construction sites during construction. Visual inspection for evidence of dust accumulation, observation of suspended particles, and ease of visibility.

Measurement of Particulate Matter (PM 2.5 & PM 10) shall be analyzed as well. The need for mitigation activities will be based on observable changes in suspended particles, visibility, and particulate matter within the air. Monitoring shall be performed continuously at stockpiled areas, site office, and community

settlement, within the immediate areas of road work of active construction zones and sensitive receptors.

2.7.4. Environmental Protection Regulations 2000 (Noise Management)

The Environmental Protection Regulations, made under the Environmental Protection Act, were gazetted in 2000. These Regulations provide rules for the emission of noise. Emission of any noise in the construction, installation, operation, modification, or extension of any facility relating to: (a) industry; (b) commerce; (c) transport; (d) construction; or (e) any institution, requires an environmental authorisation from the Environmental Protection Agency. The Agency may fix the permissible noise levels in decibels with respect to any or all the categories specified in the Schedule.

2.7.4.1. Noise

Significant noise levels during the construction phase may have potential negative impacts on settlements at the project sites, tourism activities within communities, and wildlife in the vicinity of the project, for instance the Iwokrama Field Station. Noise will be generated mainly from power generation and the use of heavy-duty equipment and machinery during construction. Demolition of existing culverts and pile driving activities for 4 bridge reconstruction may generate vibrations which can affect occupants nearby. These impacts are unavoidable and are expected to be short-term and localised.

2.7.4.2. Potential Impacts

Exposure to noise levels above the internationally accepted level of 90 decibels can cause noise-induced hearing loss. Noise levels above the tolerable threshold of 72 decibels can result in fatigue, tiredness, low morale, and decreased productivity. Heavy-duty equipment and machinery to be used for the construction are expected to generate high levels of noise. Both construction workers and the nearby communities can be affected by noise from project activities. The limit prescribed in the GNBS Noise Standard for construction activities is 90dB during the day and 75dB during the night.

There are only a few receptors of noise nuisance during the construction that include settlements along the LMH Road including Linden, Mile #47 Village, Mile #58 Village, and Mabura Hill. These receptors are not expected to be exposed to significant noise nuisance during the construction that the relevant environmental management measures are employed by ALYA. Noise is not expected to be a

significant environmental impact during the construction phase since construction will be carried out in areas mostly inhabited, or where there are already other activities occurring. However, the measures outlined below shall prevent and minimize noise, especially as it relates to impacts on workers and communities located along the road alignment.

2.7.5. Noise Level Monitoring Framework

Noise levels shall be monitored to ensure compliance with EPA's established limit of 90 decibels during the day and 75 decibels at night in worksites near communities (Construction Permit Reference No.: 20190409-MICLK.). These exercises shall be conducted continuously within the immediate areas of road work of active construction zones and sensitive receptors. It is expected that environmental monitoring would also be conducted by the EPA to determine compliance with the conditions of the Environmental Permit. Such monitoring would cover both the construction and operation phases of the project.

2.8. Environmental Protection Regulations 2000 (Water Quality)

The Environmental Protection Regulations, made under the Environmental Protection Act, were gazetted in 2000. These regulations are aimed at preventing pollution by regulating discharges and emissions.

These pollution management regulations will regulate and control the activities of developmental projects such as road construction activities. The Water Quality Regulation provides guidance to protect Guyana's water by controlling discharges of waste matter into any of the coastal and inland waters or land.

The param will issue an environmental permit for the construction of the Linden Mabura Hill Road which will further provide guidance for the management of water resources.

2.8.1. Description of the Environment

The LMH road is located on the watershed between the Demerara and Essequibo Rivers, Map 1. The existing LMH Road has no drainage system and rainwater runs off the surface of the road. At some sections of the road, makeshift turnout drains have been created and some of these drains have significantly eroded. At other sections of the road, pits have been dug on the land on either side into which water drains. At several locations, runoff has led to the formation of gullies which eroded the road edge. It is anticipated that much of the road upgrade will be

constructed within the existing road corridor; however, some vegetation clearance will be required to accommodate the proposed road and utility corridor.

2.8.2. Water Resources Management

During construction surface watercourses crossing the LMH road are at risk of the following potential impacts from the road upgrade and bridge construction:

- Pollution of watercourses due to accidental discharge;
- Leaching of contaminants from contaminated soils;
- Unsafe storage and dispensing of petroleum products;
- Sedimentation of the makeshift turnout drains and water bodies from erosion and stormwater runoff; and
- Pollution of watercourses from waste generated by road users, construction camps including solid waste and sewage during the construction phase.

Additionally, disturbance during roadway rehabilitation may potentially impact the balance between vegetation which tends to reduce erosion, and running water which influences erosion. This is an indirect, long-term impact where excessive erosion may potentially result in cumulative impacts that can extend beyond the limits of the road itself. In cases where surface water features must be temporarily diverted for rehabilitation of the road, that diversion may potentially result in water flowing over erosion-prone soils and create a greater likelihood of erosion. These impacts are indirect and long-term. These are moderate impacts with a medium level of severity and a moderate likelihood of occurrence.

2.8.2.1. Potential impacts

- Vegetation clearing to facilitate the upgrade of LMH road;
- Erosion of roads on inclines or slopes; and
- Absence of a formal drainage system thereby accelerates erosion on road edges.

2.8.3. Water Quality Monitoring Framework

Water quality monitoring will be conducted at road run-off interception points from the site during construction and at receiver water bodies impacted by construction and associated works and facilities of the project. Visual inspection for turbidity and oil and grease will be conducted following significant rain events. The need

for mitigation activities will be based on observable changes in turbidity and the presence of oil and grease within receiving water bodies.

Monitoring shall be performed monthly within streams or other significant receiving water bodies, both upstream and downstream in the vicinity of active construction sites. Water Quality monitoring parameters include:

- Temperature
- pH
- Biological oxygen demand
- Chemical oxygen demand
- Total suspended solids
- Total dissolved solids
- Oil and grease

It is expected that environmental monitoring would also be conducted by the EPA to determine compliance with the conditions of the Environmental Permit. Such monitoring would cover both the construction and operation phases of the project.

2.9. Project Size.

2.9.1. Employment

The project is expected to generate approximately 600 jobs during the entire road construction. The following are the some of the possible areas for employment:

Construction

Helpers	Drivers
Maintenance Personnel	Foreman
Electricians	Supervisors
Heavy Equipment Operators	Cooks
Engineers	Managers
Masons	H&S Officer
Cleaners	Logistics
Carpenters	Accountant
Security	Cooks
Surveyors	

The company hires local persons, including women, based on their experience and skills to support the project's construction, operational, and closure phases.

The hires of local people include, but are not limited to, community members:

- Rockstone Village
- 47 Miles
- 58 Miles
- Mabura Village
- Malali Village.

2.10. Use of nuclear Gauges.

The type of practice carried out with nuclear gauges is the determination of density and moisture due to different steps of our construction activities such as subgrade, Sub-base, Base, Binder, and Wearing Course but by two methods: retro-transmission or direct transmission mode, depending on the type of material and the thickness of the corresponding layer. The two (2) nuclear gauges described below will be used:

DESCRIPTION	QUANTITY	BRAND	MODEL	NET WEIGHT KG	GROSS WEIGHT KG
Moisture-Density Gauge	2	Humboldt	HS-5001EZ-2	13.6	41.00

2.11. Where to use nuclear Gauges.

The nuclear gougues will be used along the entire 121.2 km of road from Linden junction to Mabura Hill.



Figure 5: locations where the device will be used.

3. Environmental Management

Specific sheets include all activities, impacts and measures of the Environmental, social and safety Management related to the installation and operation of the asphalt plant, Crushing plant, workshops, roads, accommodations, etc.

IMPACTS ON THE AIR	
Activities that generate Impact	Potential Impacts
<ul style="list-style-type: none"> • Clearing vegetation • Opening of access roads • Infrastructure construction • Asphalt Plant • Crusher Plant • Machinery movement • Mining activity • Fuel Storage • Storage of aggregates. • Transportation of materials • Relocation of stone materials • Waste Management 	<ul style="list-style-type: none"> • Pollution by generation of particles and gases. • Pollution by generation of noise and vibrations
Management Measures - Sheets	
MNM 001 Management of particle and gas emissions.	
MNM 002 Noise and vibration management	
MNM 011 Waste Management	

IMPACTS ON THE SOIL	
Activities that generate Impact	Potential Impacts
<ul style="list-style-type: none"> • Cleaning and removal of vegetation cover. • Opening of access roads to the exploitation fronts. • Implementation of camps, infrastructure works, processing plants, equipment and fixed machinery. • Construction of complementary works. • Extraction of minerals. • Classification and storage aggregates. • Loading and transportation of materials. • Uninstallation and removal of infrastructure, equipment and services. • Removal of waste from the site. 	<ul style="list-style-type: none"> • Direct impact due to the development of mineral extraction. • Oil spill pollution. • Loss of fertile soil layer. • Changes in land use. • Soil erosion

IMPACTS ON THE SOIL	
Activities that generate Impact	Potential Impacts
<ul style="list-style-type: none"> Relocation of debris or non-commercial stone materials. Re conformation of degraded soils. Maintenance and regeneration of the flora in the affected and perimeter areas. 	
Management Measures - Sheets	
MNM 001 Management of particle and gas emissions. MNM 003 Soil Management MNM 004 Management of spills and soil contamination MNM 011 Waste and Sewage Management	

IMPACTS ON THE WATER	
Activities that generate Impact	Potential Impacts
<ul style="list-style-type: none"> Cleaning and removal of vegetation cover. Opening of access roads to the exploitation fronts. Implementation of camps, infrastructure works, Processing plants, equipment and fixed machinery. Construction of complementary works. Extraction of minerals. Classification and storage of aggregates. Loading and transportation of materials. Uninstallation and removal of infrastructure, equipment and services. Removal of waste from the site. Relocation of debris or non-commercial stone materials. Re conformation of degraded soils. 	<ul style="list-style-type: none"> Sedimentation contamination Alteration of natural storm drainage.
Management Measures - Sheets	
MNM 001 Management of particle and gas emissions. MNM 003 Soil Management MNM 004 Management of spills and soil contamination MNM 006 Water Management MNM 011 Waste and Sewage Management	

IMPACTS ON THE BIOLOGICAL COMPONENT	
Activities that generate Impact	Potential Impacts
<ul style="list-style-type: none"> • Prospecting and exploitation studies. • Cleaning and removal of vegetation cover. • Opening of access roads to the exploitation fronts. • Implementation of camps, infrastructure works, • Crushing and asphalt plants. • Construction of complementary works. • Uninstallation and removal of infrastructure, equipment and services. • Relocation of debris or non-commercial stone materials. • Re conformation of degraded soils. • Maintenance and regeneration of the flora in the affected and perimeter areas. 	<ul style="list-style-type: none"> • Elimination of plant cover and affectation of local fauna.
Management Measures - Sheets	
MNM 001 Management of particle and gas emissions. MNM 003 Soil Management MNM 004 Management of spills and soil contamination MNM 005 Management of berms and slopes MNM 006 Water Management MNM 007 Biodiversity management MNM 011 Waste and Sewage Management	

IMPACTS ON THE SOCIAL AND CULTURAL COMPONENT	
Activities that generate Impact	Potential Impacts
<ul style="list-style-type: none"> • Recruitment and training of personnel. • Cleaning and removal of vegetation cover. • Opening of access roads to the exploitation fronts. • Implementation of camps, infrastructure works, processing plants, equipment and fixed machinery. • Extraction of minerals. • Classification and storage of aggregates. • Loading and transportation of materials. • Uninstallation and removal of infrastructure, equipment and services. • Removal of waste from the site. • Relocation of debris or non-commercial stone materials. • Reconfiguration of degraded soils. • Maintenance and regeneration of the flora in the affected and perimeter areas. 	<ul style="list-style-type: none"> • Generation of expectations, jobs • Use of goods and services. • Affectation of the natural cultural heritage • Work risks due to the development of tasks in dangerous conditions.
Management Measures - Sheets	

IMPACTS ON THE SOCIAL AND CULTURAL COMPONENT	
Activities that generate Impact	Potential Impacts
MNM 001 Management of particle and gas emissions MNM 002 Management of noise and vibrations MNM 004 Management of spills and soil contamination MNM 009 Social Management and Staff hiring MNM 010 Work Risk Management, Safety and Health MNM 011 Waste and Sewage Management	

IMPACTS ON THE WASTE COMPONENT	
Activities that generate Impact	Potential Impacts
<ul style="list-style-type: none"> • Opening of access roads to the exploitation fronts. • Implementation of camps, infrastructure works, processing plants, equipment and fixed machinery. • Construction of complementary works. • Extraction of minerals. • Classification and storage of materials. • Uninstallation and removal of infrastructure, equipment and services. • Removal of waste from the site. 	<ul style="list-style-type: none"> • Solid waste generation. • Pollution due to the generation of sewage or sewage
Management Measures - Sheets	
MNM 006 Water Management MNM 011 Waste and Sewage Management	

3.1. Instructions on the use of Environmental Management Sheets (EMS)

The EMSs contain the following information:

- **Record number:** sequential numbering composed of the initials and the sequential number. It will be used the acronym for the non-metallic mining sector is MNM, which refers to its initials.
- **Title:** refers to the type of management described in the card.
- **Objective:** It describes what the objective of the sheet is, that is, what the measures recommended in that sheet pursue.
- **Cause of environmental impacts:** the actions that can cause the impacts to occur.
- **Affectation:** describes what happens when the measures recommended in the Guide are not applied.
- **Actions to develop:** describes the measures that can be applied to achieve the objective of the Guide.

- **Technique or technology to be used:** describes the suggested techniques to be applied.
- **Place and period of application:** indicates where and when the recommended measures are applied.
- **Responsibles:** indicates who can take care of the implementation of the recommended measures.
- **Monitoring:** actions that the contractor will carry out to follow up on the measures applied and determine their effectiveness.

These sheets will be used as guides to do control measures that allow the Contractor to manage the support activities for the road construction in an appropriate manner and according to current regulations. They are used as a reference manual, where solutions can be found to the problems that arise in the environmental management in the production process.

These measures are part of the environmental management of the project and are intended to be a useful tool in achieving a more sustainable mining and support activities.

3.1.1. MNM N° 001 - Management of Particulate and Gas Emissions

SHEET N° 001 - MANAGEMENT OF PARTICULATE AND GAS EMISSIONS	
Objective: Prevent and reduce particle and gas emissions generated by mining, industrial plants, machinery and vehicles in operation.	
Environmental impacts	
Causes	<ul style="list-style-type: none"> • Clearing vegetation • Opening of access roads • Infrastructure construction • Asphalt Plant • Crusher Plant • Machinery movement • Mining activity • Fuel Storage • Storage of materials • Transportation of materials • Relocation of stone materials • Waste Management • Relocation of debris or non-commercial stone materials.

	<ul style="list-style-type: none"> • Impact due to the opening and use access roads and internal rads
Impacts	<ul style="list-style-type: none"> • Pollution from particle and gas emissions
Actions / Measures	
<ul style="list-style-type: none"> • The machinery and equipment will have effective and efficient maintenance • Water is used in the processes that allow it, to avoid detachment of particles • Location of stockpiles will be guided by the prevailing winds which is the northeast • Speed limits will be applied to unsealed roads to limit dust generation (Max 30 km/h) • Mining area will have vegetation barriers that they can act as windbreaks to help alleviate dust generation. The vegetative buffer zone will have at least 200 (two hundred) meters between the quarry and other contiguous land uses. • It will be established vegetation around production facilities and along access roads • Temporary stockpiles will be protected from wind erosion • During periods of high wind speeds (Sustained speeds of 40 to 57 mph), operations will be ceased or curtailed to prevent excessive dust • Haulage Roads and Service Roads and access roads will be regularly sprayed with water. The frequency will be minimum twice per day and depends of the climate conditions. 	
Technique / Technology to be used	
<ul style="list-style-type: none"> • In the process of moistening the project area surface, tanks or other systems are used that adapt to the topographical and access conditions. In all cases only clean water is used. • The crusher plant will have mist sprays or another dust suppression equipment in the transfer points to reduce the level of fugitive dust • Will be minimized the distance between the discharge point and the top of the stockpile • The asphalt plant will have treatment of dusty air with baghouse filter • Covers will be used to fix light materials in piles • Wind erosion in piles will be controlled by awnings • Provision of tarpaulins or other mechanisms to cover them according to storage needs. • Use of tarpaulins to cover the trucks that transport the material • The speed of the traffic will be regulated in the work zone in order to avoid the raising of dust clouds during its movement 	
Place of application	Haulage roads and service roads, crusher plant and asphalt plant area, mining area.
Application period	During the operation of the project.
Responsible	Professional(s) responsible for the design, planning and operation. Environmental Engineer for the environmental management.

Monitoring
<ul style="list-style-type: none"> • Air Quality Monitoring Procedure. • Periodic verification of the recommended measures in the field • If inefficiencies are observed in machines and may result in visible emissions to air, the operator shall: investigate and undertake remedial actions immediately, adjust the process or activity to minimise those emissions and record the actions taken

3.1.2. MNM N ° 002 - Management of Noise and Vibrations

SHEET N° 002 - MANAGEMENT OF NOISE AND VIBRATIONS	
Objective: Prevent and reduce as much as possible the pollution caused by the generation of noise and vibrations	
Environmental impacts	
Causes	<ul style="list-style-type: none"> • Clearing vegetation • Opening of access roads • Infrastructure construction • Asphalt Plant • Crusher Plant • Machinery movement • Mining activity • Fuel Storage • Storage of aggregates • Transportation of materials • Relocation of stone materials • Waste Management
Impacts	<ul style="list-style-type: none"> • Pollution due to the generation of noise and vibrations caused by the machinery that will operate in the project. • Direct impact on the soil due to the development of mineral extraction activities. • Impact due to the opening and use of internal and access roads.
Recommended Actions / Measures	
<ul style="list-style-type: none"> • The machinery and equipment used in the project have an effective and efficient maintenance. • Detonations for mining extraction will only occur during daylight hours and according to a previously established program. • Ensure the appropriate blast design parameters are in place prior to the actual blasting. Attain minimum ground vibration by the utilization of: <ul style="list-style-type: none"> - Appropriate delay intervals for charge ignition - Appropriate pattern - Orientation of blast holes - Confinement of the charge <p>These parameters are included in the <i>Drilling and Blasting Plan</i></p>	

- When the technical specifications allow it, low-density explosives and low detonation speeds will be used for blasting because they produce lower levels of vibrations.
- Mining area will have vegetation barriers that they can act as windbreaks to help alleviate dust generation. The vegetative buffer zone will have at least 200 (two hundred) meters between the quarry and other contiguous land uses.
- When, as a result of the operation of the machinery in the project area, noise and vibrations have been generated causing complaints from people living nearby, a mechanism for dialogue and search for appropriate solutions will be established, to avoid disturbances.
- During the crushing activities and in the asphalt plant activity, PPE will be used (protective equipment, plugs or earmuffs)
- Reduce Speeds of empty hauling trucks
- Sound-making devices like generator, planers, etc. Will have silencers to reduce noise level and/or enclose all sound making devices in structures constructed with materials of good insulation properties.

Technique / Technology to be used

- The machinery used for earthmoving (bulldozers, graders, excavators) and other equipment (generating plants, air compressors, cranes, etc.) will be provided with silencers.
- Natural sound barriers will be generated using shrubby vegetation
- In explosions, to mitigate the level of the wave in the air, the following recommendations are followed:
 - Bare detonation cord lengths are reduced or, where possible, covered with fine sand.
 - Explosive charges per micro-delay unit are reduced.
 - It is ensured that the explosive charges are confined within the blastholes.
 - It is convenient to wait until the wind does not have the direction with the inhabited area.
 - Geometric schemes and firing sequence are selected to avoid wave reinforcement.
 - Between the blasting area and the receiving points, screens of vegetation and earth are built, so that the wave is reflected in them.
 - The delay times are chosen so that the progression of the blasting along the front is carried out at a speed less than the speed of sound.
- To control projections and vibrations produced by blasting, the following recommendations are considered:
 - The layout of the drilling pattern is carried out with precision, especially in the first row of the blast.
 - The depth and inclination of the drilled holes are controlled.
 - The loading of explosives and their distribution is controlled.
 - An appropriate firing sequence is chosen

Place of application	Sectors of the mining project where explosions are carried out or where machinery and equipment generate noise or vibrations.
Application period	During the operation of the Project

Responsible	Professional(s) responsible for the design, planning and operation. The professional responsible for the management and the application of the measures is the HSE Supervisor
Monitoring	
<ul style="list-style-type: none"> • As part of the environmental management tasks of the mining project, the Contractor has developed a self-control and monitoring mechanism, which includes periodic monitoring of the noise, carried out by the environmental manager, the safety manager and the project blasting manager. • The monitoring program consists of the periodic verification of the recommended measures, aimed at monitoring the proper environmental and social development of the project. • It is verified that workers use protective plugs or earmuffs. • It will be applied the Noise Quality Monitoring Procedure to comply the national standards 	

3.1.3. MNM N° 003 - Soil Management

SHEET N° 003 - SOIL MANAGEMENT	
Objective: Promote an effective management of the environmental impacts caused on the soil by the development of mineral extraction activities and the operation of industrial plants.	
Environmental impacts	
Causes	<ul style="list-style-type: none"> • Extraction of minerals • Vegetation clearing • Opening of access roads • Fuel Storage • Storage of materials • Transportation of materials • Construction of complementary Works • Workshop • Asphalt Plant
Impacts	<ul style="list-style-type: none"> • Direct impact on the soil due to the development of mineral extraction activities. • Soil contamination due to sediments • Loss of topsoil • Changes in land use • Changes in the morphology and topography of the project area.

	<ul style="list-style-type: none"> • Impact due to the opening and use of internal and access roads. • Alteration of the local drainage system • Water erosion
Recommended Actions / Measures	
<ul style="list-style-type: none"> • It will be maintained natural vegetative cover, especially in the vicinity of steep slopes occurring at project site. • Storage of topsoil (overburden) within three meters (3m) of natural vegetation or mine face is strictly prohibited. • Topsoil and vegetation will be carefully stripped and stockpiled in an allocated area marked by a sign, so that it can be used for reclamation and re-vegetation as mining finishes. • Store overburden stockpiles at least 200 m. away from any water courses. • Runoff from the overburden will be directed to sedimentations ponds treatment before discharge • Tree cover areas located in watercourse protection zones will be respected. • Drainage systems will be designed and established • It will be considered the weather pattern before initiating major earthworks • Avoid soil compaction, erosion, rutting and sedimentation during operation by limiting the size of the disturbed area, slope length and gradient, and the duration of soil exposure. 	
Technique / Technology to be used	
<ul style="list-style-type: none"> • Drainage systems will be directed to the sedimentation ponds • The larger blocks of material that are not used in the crusher plant are placed as energy sinks and filters in rainy season • Soil erosion in the roads will be reduced by using uncovering material from the quarry. 	
Place of application	Mining area
Application period	During the operation of the project
Responsible	Professional(s) responsible for the design, planning and operation. Safety and Environmental responsible for the management and the application of the measures
Monitoring	
<ul style="list-style-type: none"> • Stockpiling areas are monitored, including removal soils and land preparation, so that they are not carried down the slope by runoff and sedimentation of the local drainage • Monitor areas of exposed soil during periods of heavy rainfall • Also apply all measures established in the MNM No. 004 	

3.1.4. MNM N° 004 - Management of Spills and Soil Contamination

Objective: Avoid soil contamination due to possible spills of fuel and oils from machinery, work equipment or fuel storage	
Environmental impacts	
Causes	<ul style="list-style-type: none"> Implementation of camps, infrastructure works, processing plants, equipment and fixed machinery. Construction of complementary works. Extraction of minerals. Classification and storage of materials. Loading and transportation of materials. fuel storage Workshop
Impacts	<ul style="list-style-type: none"> Soil contamination due to fuel or oil spills, due to dripping from machinery and work equipment. Work risks due to the development of tasks in dangerous conditions.
Recommended Actions / Measures	
<ul style="list-style-type: none"> Machinery and equipment will have periodically maintenance and adjustment For the loading of fuel or other substances of this type, there is a fuel dispenser and elements (buckets with sand, spill collection trays, etc.) that allow retaining and containing any type of drip or accidental spill, with in order to avoid, as far as possible, that it can make direct contact with the ground. Fuel trucks will be used for loading fuel at work sites, each fuel truck will have a spill kit. As far as possible, the loading of fuel is given in the work area only to the heavy machinery that requires it. Pick-ups and other equipments that are easier to mobilize will receive it in the fuel dispensing area. Used oils after the maintenance of the machinery are properly collected The used oils will be storage under roof, in an impermeable surface and with spill containment wall In the maintenance processes of the machinery within the project area, used oils and exchange fats will be delivered to external company dedicated and authorized commercialization of these residues. Heavy machinery will have to be transported to the workshop for major mechanical repairs and avoid unnecessary spills in the soil. Machinery and mechanized equipment are operated only by designated qualified personnel Necessary spill control training and the use of spill kits will be carried out for all employees. There will be grease traps to retain spills; these traps receive regular cleaning and maintenance. 	
Technique to be applied	
Fuel Storage	

- Will have an impervious secondary containment wall around fuel storage tank, creating a temporary holding area in the event of accidental spillage. The containment wall for the area with multiple tanks will have the capacity to provide at least 110% containment of the largest tank.
- All piping must enter or exit the containment over the wall and no part of the infrastructure (e.g. dispenser, filling hoses and valves) shall protrude outside the containment
- All adequate signage will be installed in fuel storage areas, such as "No Smoking", "Flammable materials", etc.
- Fire emergency equipment is available
- There are trained personnel responsible for handling fuels.
- The personnel responsible for handling fuels has the indicated work equipment.
- There are buckets of sand and spill kits to contain occasional spills that may occur during loading.

In the event of spillage of combustible liquid, the following recommendations are going to be followed:

Place a demarcation tape to warn of the danger

- Immediately notify people in the vicinity of the spill area.
- All non-essential people in the care of the event must be removed from the area
- Safety and environmental responsible must be informed of the emergency
- Any sources of ignition or heat in the area must be turned off.
- The spill must be confined or contained to prevent its spread.
- The fault of the leak will be reviewed, if the fault is structural in the storage tank, tanks should be brought in to temporarily store the spilled material, using a pneumatic pump. If the spill has been due to overflow of the tank, the reception activities in the tank must be suspended, and then proceed to collect the material with a pneumatic pump.
- Cover spill area with sand, sawdust, or absorbent material. All items that have been splashed are carefully removed
- All elements and contaminated soil are collected and transferred in specific bags to the area designated for temporary storage.

Protection measures for fuel storage tanks such as painting, and coating will be maintained to minimize corrosion of fuel tanks

Leak detection systems will be installed on a fuel tanks, like gauging system, dipstick measurements, sensors on walls of tanks.

Place of application	-Areas where machinery operates, vehicles circulate -Fuel Storage -Workshops
Application period	During the operation stage
Responsible	Personnel in charge of the operation and maintenance of equipment and machinery.

	<p>The personnel in charge of the fuel storage will carry out daily controls of the storage tanks to detect any leaks.</p> <p>The environmental specialist and the HSE Supervisor will be responsible for managing the environmental and safety management of the project, they will carry out follow-up and monitoring.</p>
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Tracking and monitoring

- The monitoring program consists of monthly verification of the storage tanks to detect any loss, which will be immediately communicated to those responsible for the environment and safety to take the necessary precautions.
- Control of fuel loading and unloading devices. Maintenance and/or repair of fittings, pipes and hoses will be conducted monthly.
- Periodic control of spill kits, spill containment bins

3.1.5. MNM N° 005 - Management of Berms and Slopes

SHEET N° 005 - MANAGEMENT OF BERMS AND SLOPES

Objective: Establish compensatory measures and actions for the environmental effects caused in the soil by the loss of the organic layer, changes in the geographic space of the project area, its morphology and topography, in the design and management of slopes.

Environmental impacts

Causes	<ul style="list-style-type: none"> • Cleaning and removal of vegetation cover. • Opening of access roads to the mining • Implementation of camps, infrastructure works, processing plants, equipment and fixed machinery. • Construction of complementary works • Relocation of debris or non-commercial stone materials • Regeneration of the flora in the affected and perimeter areas
Impacts	<ul style="list-style-type: none"> • Direct impact on the soil due to the development of mineral extraction activities. • Loss of fertile soil layer. • Changes in land use. • Changes in the morphology and topography of the project area. • Alteration of the local storm drainage system. • Effects on the infiltration recharge capacity of the zone under the area of operation. • Landslides (mass movements)

Recommended Actions / Measures

- In the creation of slopes for the operations, the area strictly defined for the mining project is used, with a minimum affectation of the other zones.
- Extracted organic soil from the slopes will be used to start the process of recovering the vegetation.

<ul style="list-style-type: none"> • By forming the slopes, areas with vegetation located in areas of protection of watercourses are respected. • Drainage systems will be established for slope management. • Warning signs will be available to help prevent any type of accident with people or animals. 	
Technique / Technology to be used	
<ul style="list-style-type: none"> • A surface drainage system is designed for the water to be intercepted on the inner face of the mining slopes. • The detonations to break up and pre-fracture the existing rock will be carried out with the authorized blaster based on the Drilling and Blasting Plan. • Mining terraces will have a width of between 2.5 and 5 m, both temporary and final. • For the temporary and final mining slopes, angles must be between 60 and 74 degrees of inclination respect to the horizontal. 	
Place of application	In all areas of the project where slopes are established, earthworks are carried out, as well as in the material extraction and exploitation fronts.
Application period	During operation stage
Responsible	Professional(s) responsible for the design, planning and operation of the quarry Technicians in charge of the development of intervention works and modifications to the land, specialist in drilling and blasting.
Monitoring	
<ul style="list-style-type: none"> • Special care will be taken in the degree of fracture of the rock before and during the work on the mining fronts, checking that there are no unstable rocks that could fall down the slope. If this situation is identified, a removal of these blocks will be done. 	

3.1.6. MNM N° 006 – Water Management

SHEET N° 006 – WATER MANAGEMENT	
Objective: Control and mitigate the environmental effects caused by alterations in the water's quality and in local patterns of pluvial drainage.	
Environmental impacts	
Causes	<ul style="list-style-type: none"> • Opening of access roads to mining fronts • Implementation of camps, infrastructure works, processing plants, equipment and fixed machinery. • Construction of complementary works • Extraction of minerals • Relocation of debris or non-commercial stone materials. • Changes in the morphology and topography of the project area • Workshop

<p>Impacts</p>	<ul style="list-style-type: none"> • Direct impact on the soil due to the development of mining activity • Pollution from oil and fuel spills, due to dripping from machinery and work equipment • Changes in land use • Contamination of surface water due to the contribution of sedimentary particles (turbidity) or fuel/oil from machinery or work equipment. • Alteration of the local natural storm drainage system • Elimination of vegetal cover and affectation of local fauna.
<p>Recommended Actions / Measures</p>	
<ul style="list-style-type: none"> • The machinery and equipment have an efficient and constant maintenance to avoid spills of fuel and oils • As far as possible, it will be maintained the natural condition of storm drainage existing in the project area. The drainage system will be designed and developed approaching the current natural condition, considering the topography and adapting it to the quarry exploitation design. • The designed channels will allow the mobilization of water, preventing accumulations or swamping of rainwater at the extraction site. • During periods of intense rain, earthworks will be avoided, to minimize the transport of sediments from the work areas to the receiving channels. • During the construction and exploitation phases, the project is limited to using the strictly necessary and planned area for the development of the works • Taking advantage of the large amount of rainfall in the site where the Project is developed, rainwater collection systems will be developed and its use will be promoted for some activities, for example for road irrigation in dry seasons. • Training program promoting an effective use of water, its care and avoid excessive spending. • Is prohibited thrown waste into bodies of water • Accumulation of overburden and rocks is avoided to favour the free circulation of drainage • Is prohibited extraction of water in points upstream in creeks used by communities. The extraction will be done downstream the abstraction's point of the community. • Septic tanks will be installed, equipped with filter bed and soak 	
<p>Technique / Technology to be used</p>	
<ul style="list-style-type: none"> • Waters with sediments are channelled towards the waterfall-type retaining walls. Following the contour lines, the waters with sediments will be channelled towards the sedimentation pool, before they are emptied into the local and natural drainage of the area. • Sanitary services with septic tank will be used • The piles of already crushed material will be on flat land, to avoid dragging by runoff. 	

<ul style="list-style-type: none"> It will be determined the protection areas for the surface water, creeks and others. 	
Place of application	In the mining area and in the industrial area
Application period	During operation stage
Responsible	Professional(s) responsible for the design, planning and operation, as well as the rest of the personnel in charge of the mining, service and maintenance works. The environmental specialist and safety specialist will be responsible for managing and they will do monitoring.
Monitoring	
<ul style="list-style-type: none"> The monitoring program consists of periodic verification of surface drainage channels 	

3.1.7. MNM N° 009 - Social Management and Staff Hiring

SHEET N° 009 - SOCIAL MANAGEMENT AND STAFF HIRING	
<p>Objective: Promote adequate social management of the project, in order to avoid the generation of false expectations, conflicts and externalities of the project that can cause conflicts due to its inappropriate socialization.</p>	
Environmental impacts	
Causes	<ul style="list-style-type: none"> Prospecting and evaluation studies. Recruitment and training of personnel Cleaning and removal of vegetation cover Opening of access roads to the exploitation fronts Construction of support activities infrastructure, asphalt plant, crusher plant, workshop. Mining activity Classification and storage of materials Transportation of materials Waste management
Impacts	<ul style="list-style-type: none"> Generation of employment and economic expectations in nearby communities. Generation of uncertainty in local communities about the advantages or disadvantages of the project Generation of jobs Impact on cultural and natural heritage Noises and vibrations Work risks due to the development of tasks in dangerous conditions.
Recommended Actions / Measures	
<ul style="list-style-type: none"> Communities neighbouring the project area will be informed about the blasting activities at least two weeks before the blasting 	

- Special attention to any complaint of nuisance manifested by the neighbours of the project. This is recorded and immediately passed on to social and community officer, in order to proceed to solve the situation.
- The personnel and their activities are kept under a follow-up in accordance with the customs and activities of the area (frequency and working hours, holidays, etc.).
- The wages, benefits and guarantees of the workers are complied with.
- Work schedules are defined that do not alter public tranquillity, both for the working day of the staff and for the times of loading, transporting and grinding material
- Neighbours will be periodically consulted about the perception of inconvenience from the development of project activities
- Contractor will have prior on hiring local labour supply
- It is guaranteed that the subcontractors of the project comply with the labour legislation
- A health and safety program is applied to the project, including risk prevention, response to emergency situations and compliance with the provisions of the C-ESMP.
- The machinery and equipment used will operate and circulate during daylight hours.
- The contractor will have 24-hour private security to prevent the entry external people to the industrial area and the mineral material extraction area.
- A contingency plan is disclosed and applied in the project area and personnel are trained in emergency response and accident care. This plan is established in the C-ESMP
- Application of the Stakeholder Engagement Procedure

Technique / Technology to be used

- Access will have identification signs of the industrial area
- All excavations will be done in compliance with the safety measures, regarding the management of work risks
- A contingency plan will be shared with all employees
- Training in Environmental Education, Safety and Occupational Health for all employees
- PPEs will be provided to all Contractor personnel

Place of application	Area of influence of the industrial area
Application period	During project operation
Responsible	Professional(s) responsible for the design, planning and operation of the quarry and the industrial area The professional responsible for the measures include in this sheet is the Social Officer, the Environmental engineer and Safety engineer.

Monitoring

- The Stakeholder Engagement Plan, Grievance redress mechanism, is followed up in order to minimize or avoid inconvenience with the neighbour community

3.1.8. MNM N° 007 – Biodiversity Management

SHEET N° 007 – BIODIVERSITY MANAGEMENT	
Objective: Control the vegetation clearing and the impact in the local fauna, as well as promoting adequate management of the regeneration of local conditions	
Environmental impacts	
Causes	<ul style="list-style-type: none"> • Prospecting and evaluation studies • Vegetation clearing • Opening of access roads • Construction of the support infrastructure, asphalt plant, crusher plant, workshop.
Impacts	<ul style="list-style-type: none"> • Loss of fertile soil layer • Changes in land use • Susceptibility to water and wind erosion • Affectation of local fauna. • Impact on the landscape • Impact due to the opening and use of internal and access roads.
Recommended Actions / Measures	
<ul style="list-style-type: none"> • Workers will not be able to enter the wooded areas adjacent to the Project area. The extraction of specimens of flora and fauna is prohibited • It will be prohibited to dispose of waste mineral waste or any other type of waste in the areas of forest cover adjacent to the Project • If during the development of the project an important niche of local fauna is found, its respective protection and/or transfer to another natural environment will be carried out. • No waste is discharged directly onto forested areas • All workers will be trained in identification of species of conservation importance based on the Guyana Wildlife Regulations, to take care and communicate to Environmental Engineer for the register if they observant any animal. • Hunting of wildlife is prohibited, as well as the purchase or captivity of animal species in the area. • Awareness talks for the protection of local fauna 	
Technique / Technology to be used	
<ul style="list-style-type: none"> • Reclamation plan will be developed promoting natural regeneration of the vegetation • The organic soil from clearing will be used for reclamation 	

<ul style="list-style-type: none"> In general, among the compensation measures, there is the reforestation of the areas with species native to the place to protect the soil, rescue the flora and fauna, and create a barrier that cushions the effects of the intervention 	
Place of application	Haulage roads and service roads, crusher plant and asphalt plant area, mining area.
Application period	During project's operation
Responsables	Professional(s) responsible for the design, planning and operation of the quarry and industrial area. The professional responsible for the measures include in this sheet is the Environmental engineer
Monitoring	
<ul style="list-style-type: none"> Biodiversity monitoring is carried out in the project area and its surroundings. 	

3.1.9. MNM N° 010- Work Risk Management, Safety and Health

SHEET N° 010- WORK RISK MANAGEMENT, SAFETY AND HEALTH	
<p>Objective: Prevent risks to the health of workers due to the development of work in dangerous conditions; ensure industrial safety and occupational health measures. These measures also include subcontractors, suppliers and residents of the area.</p>	
Environmental impacts	
Causes	<ul style="list-style-type: none"> Clearing of vegetation Opening of access roads Construction of support infrastructures: crusher plant, asphalt plant. Crusher Plant Asphalt Plant Mining activity Classification and storage of materials Transportation of materials Heavy duty equipment
Impacts	<ul style="list-style-type: none"> Work risks due to the development of tasks in dangerous conditions Negative effects on the body due to exposure to chemical elements Health risk due to exposure to animals and natural environment
Recommended Actions / Measures	
<ul style="list-style-type: none"> The company trains and equips all its workers with adequate training and the required safety equipment, as required by the activity they perform. Workers have health insurance Facilities or workplaces are always kept in a sanitary (clean and orderly) condition. 	

- Work instruments are stored properly to avoid deterioration or any risk or contingency that endangers the safety of workers or residents of the area.
- The work areas are equipped with basic services, such as drinking water for consumption, toilets by gender, among others.
- The working hours established in the current norm are complied with
- Individual protection and first aid equipment will be provided for workers
- There is equipment for fire extinction and control in all areas. Fire extinguishers are identified and placed in an accessible place.
- All hazardous areas will be identified
- Workers and operators who are exposed to the noise and particles generated by the crushers have the corresponding industrial safety elements, adapted to the climatic conditions: ear plugs, face masks, work clothes, helmet, gloves, boots and any other more specific depending of their functions. This equipment will be provided by the Security Officer
- Workers who do not use PPEs will be sanctioned.
- All areas will be properly identified
- The project area has prevention signs to avoid traffic accidents.

Technique / Technology to be used

- Toolbox talk will be scheduled for workers about safety and health practices
- Workers will be trained about safety at work, considering the different types of work, the general and specific risks to which they are exposed and the best way to prevent them.
- Haulage roads and access roads complies with technical and safety standards
- All employees will be trained in dangerous tasks
- Circulation areas, as well as stacked or covered material, are kept moist to prevent excessive dust generation.

Place of application	Haulage roads and service roads, crusher plant and asphalt plant area, mining area.
Application period	During project operation
Responsible	Professional(s) responsible for the design, planning and operation, in addition to the rest of the personnel who participate in the execution of extraction, maintenance, etc. The professional responsible for the measures include in this sheet is the HSE Supervisor.

Monitoring

- The Contractor ensures that all its workers apply occupational safety measures
- A strict internal security will be implemented.
- The monitoring program consists of the periodic verification of the recommended measures aimed at monitoring the proper development of the project.
- It is reviewed that the industrial safety and human health measures proposed contribute to minimize the risks of accidents implicit in the mining activity.

- Control of dust production, signalling and training of personnel, as well as good engineering practices in general.
- It is verified that the contents of the portable first aid kits are adequate
- Daily verification of the hygiene conditions of the accommodations
- The noise levels generated in the quarry area and exploitation fronts will be verified. See sheet No. 002

1.1.1. MNM N° 011 - Waste and Sewage Management

SHEET N° 011 - WASTE AND SEWAGE MANAGEMENT

Objective: Promote integrated waste management and sewage management, to avoid negative impacts in the environment

Environmental impacts

Causes	<ul style="list-style-type: none"> • Opening of access roads • Implementation of support infrastructure: accommodations, workshop, asphalt plant, crusher plant • Mining activity • Loading and transportation of materials.
Impacts	<ul style="list-style-type: none"> • Pollution by generation of solid waste.

Recommended Actions / Measures

- Contractor will promote reduction, recycling and/or reuse using separate bins to facilitate the collection and sorting of waste according to liquid and solids, organic and inorganic, etc.
- Is prohibited waste disposal in or near to any waterways
- The ordinary solid waste generated is collected and transported to the solid waste pits
- Sanitary dumpsites will be constructed above the ground water table and lined to the floor with an imperious earthen or other material to prevent leaching to ground water
- Solid waste pits will be located at least 100 meters away from any watercourses, or habitation.
- Maintain good housekeeping, sanitary and hygienic practices and the aesthetic quality of the surroundings at all times.
- Topsoil and overburden will be accumulated to be used in revegetation and reclamation plan.
- Workers are prevented from throwing waste anywhere, to avoid unauthorized dumps.
- Waste collection it will be done periodically, at least once a week, depending of the generation.
- All waste produced in oil or fuel spill will be considered as hazardous waste and threatened like one.
- Hazardous waste like batteries will be temporarily stored in an impermeable surface beneath the roof.
- A program for the rational use of water is promoted, in such a way that waste is avoided, and the minimum amount of liquid waste is generated.

<ul style="list-style-type: none"> • It will be promoted a rational use of water looking for the minimum amount of liquid waste is generated. • Construct and maintain a septic tank system onsite. 	
Technique / Technology to be used	
<ul style="list-style-type: none"> • Separate binges for waste temporary disposal • The waste will be disposed in sanitary dumpsites created exclusively with impermeable materials at least 100 meters from watercourses • Organic type waste will be separated for composting and subsequent production of organic fertilizer • Septic tank for sewage treatment will be accessible for cleaning and de-sludging. Septic tanks will be installed with a sand and charcoal filter bed. 	
Place of application	Industrial area
Application period	During project operation
Responsible	Professional(s) responsible for the design, planning and operation, in addition to the rest of the personnel who participate in the execution of all tasks, especially those of maintenance, housekeeping and general cleaning. The professional responsible for the measures include in this sheet is the Environmental engineer
Monitoring	
<ul style="list-style-type: none"> • It will verify that hazardous waste is correctly managed • It will verify that the solid waste of the camp is properly disposed for composting in the sanitary dumpsites. • Training for all employees on waste separation • The project, through its environmental officer and technical managers, maintains a monitoring program for wastewater management, and preventive or corrective measures when necessary. 	