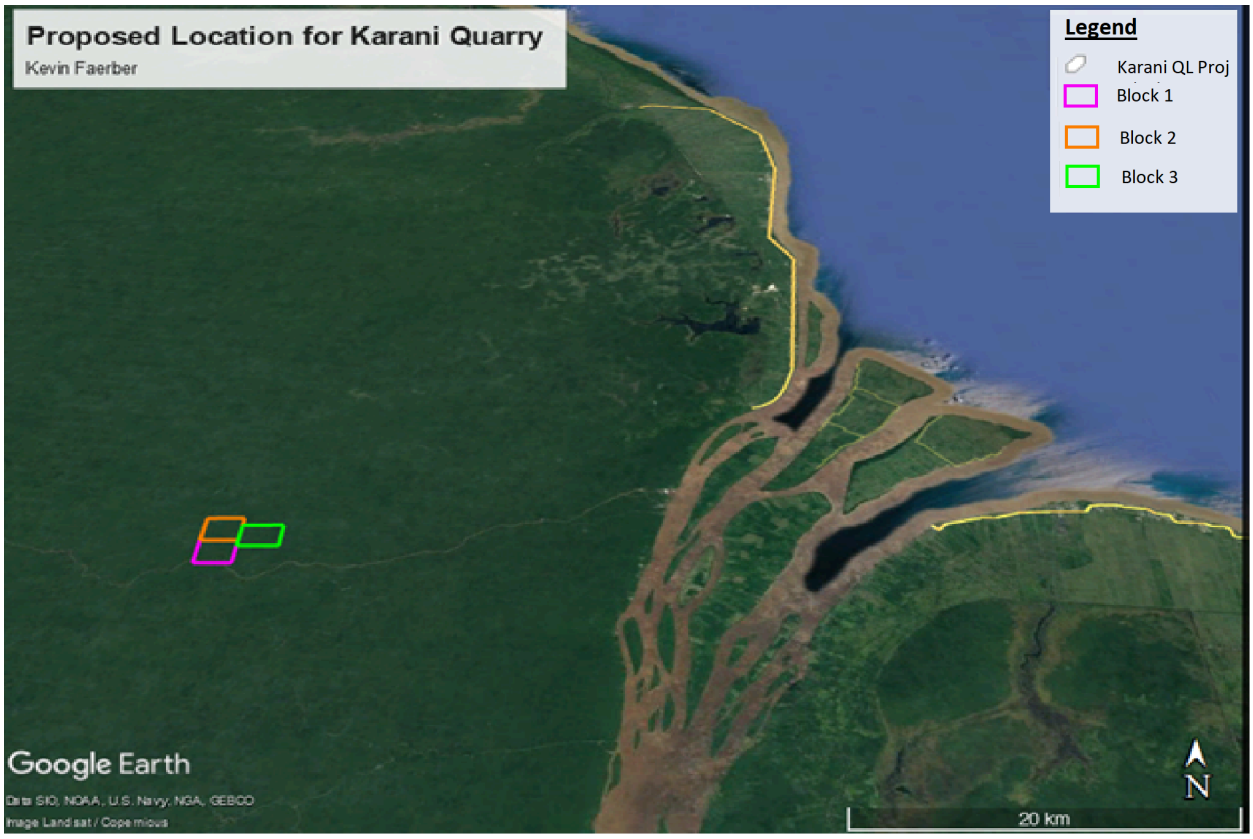
Kevin Faerber.

Karani Quarry

Project Summary



Karani Quarry, Left Bank Essequibo River

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Date: July, 2022

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Executive Summary

1) Mr. Kevin Faerber recognizes the demand for aggregate, the current limitations of supply, and the anticipated increase in demand from the emerging oil and gas sector and the expanding construction sector.

2) As such, Mr. Kevin Faerber seeks to obtain from the Guyana Geology and Mines Commission (GGMC) a series of three contigious mining permits for quarriable material, to develop a modern, large-scale quarry to meet the existing and projected demand for aggregate.

3) The Saxacalli, Rock Point, Makouria, and Dalli quarries are all located on the Essequibo River, in the vicinity of the location of the proposed new quarry development.

4) The proposed Karani Quarry project site is located on the left bank of the Essequibo river, ~30 km NW of Bartica, ~30 km from Parika, and ~50 km from Georgetown, all distances measured along the riverain routes.

5) The potential for hard rock occurrences which may become exploitable quarry material is very good. The region is part of the Trans-Amazonian Craton, and the underlying rocks are collectively known as the Barama – Mazaruni Supergroup (BMS), and the QL, more specifically, lies on the younger intrusions within the Bartica - Gneiss Complex. The general area is covered by young alluvium, fluviatile materials as well as saprolitic material. However, the work at the historic Saxacalli, Rock Point, Makouria, and Dalli quarries have all exposed fresh rock at and close to the surface. This, together with other observed float rock and the topographic indications of the underlying the ‘hard rock’ materials being good indicators of extensive quarriable material.

6) The Karani Quarry Project lies on the major dominant regional structural trends of younger mafic/ultramafic intrusions and is perfectly placed to host a significant quarry reserve

7) The proposed project site encompasses approximately ~1,173 acres of land. This covers an unnamed, large topographic high that is over 200 feet in elevation and occupies most of the aerial extent of the proposed QL. The elevation at the bank of the Essequibo River is less than 40 feet.

8) This topographic high will be the initial focus for the development of the new quarry, where initial reconnaissance has shown the presence of rock at and close to the surface.

9) The main operational center will be closer to the north western sector of the license; rocks harvested from the central and eastern sectors will be transported here for processing into aggregate or will be shipped as boulders for use in sea defense projects if needed.

10) The proposed QL is on the left bank of the Essequibo river, approximately 20 miles along the Buckhall road. At this point, the Essequibo river is easily navigated with sizable vessels.

11) Alternatively, the QL is already connected by trails to Buckhall. Transport will also be possible by trucks along these routes.

12) The company will be investing and expending approximately one million, five hundred thoudsand United States Dollars (US$1,500,000) in the development and commissioning of this new quarry operation.

13) This investment is being made to meet the growing demand for aggregate domestically as the economy continues to be boosted by increasing construction, infrastructure, and sea defense works, with further expansion anticipated with the increasing oil production-related activities.

14) The initial output of this quarry is expected to be at least 6750 tons per week of aggregate (½", ¾," ⅞").

15) The company is committed to being a responsible corporate partner to the Government of Guyana and is currently assembling a team of experienced and professional persons to manage this project.

16) This project developmental plan will be revised at the direction and requirements of the relevant regulatory bodies.

1.0 Introduction

The company is currently applying for a a series of 3 contigious mining permits from the Guyana Geology and Mines Commission (GGMC). The MPs being proposed cover an approximate aggregaet area of ~3500 acres and lies to the west of the historic Saxacalli and Rock Point Quarries. This proposed QL is located approximately on the left bank of the Essequibo River, 20 miles along the Buckhall road. This area was selected and located based on the numerous historic and active quarries in the area. The indications of fresh rock suitable for aggregate are present in the topographic high that occurs along with a W/E trending mafic intrusion that dominates this entire area.

A historic and respected estimate by the notable H. Schielly in 1968 from the surveys and work he did in all of the potential quarry sites in Essequibo - Mazaruni - Cuyuni confluence area places the reserves of the Rock Point quarry at 150,000 tons. This reserve is based on many geological conditions very similar to those that occur in the proposed QL but at much lower elevations. After initial developmental works, a consolidated reserve estimate will be arrived at through a comprehensive drilling program with significant resources anticipated in the topographic highs to the eastern sector of the proposed QL.

For this project, it is estimated that not less than 6750 tons of rock will be produced per week for the first phase of established production. The annual output for the first few years during the consolidation of operations will be ~330,000 tons of aggregate, boulders, and other sea defense-related materials. After the recovery of a substantial portion of the capital investment, the second phase of investment and expansion will increase production. The quarry will see a capital investment of not less than USD 1,500,000 and will have an initial workforce of at least 30 (local) employees. Development of the facilities for this quarrying complex will be completed within 6 to 8 months of the MPs being granted. The primary reason for establishing this quarry is to satisfy the current and anticipated demand based on the Ministry of Public Infrastructure and the private sector projections.

2.0 Physiography, Location and Access

The Karani Quarry Project Block 1 area is centered on N 6° 50' 44.9232", W 58° 49' 29.0856" in the Cuyuni #4 mining district, central-northern Guyana (See Map 2). The area is approximately 50 km southwest of the capital city of Georgetown, and the closest town is Bartica, some 30 km to the southeast, all distances along the riverain routes.

The Project area is located in the Amazon rainforest of Guyana. It is bracketed to the north by the Supenaam River, to the east by the Essequibo River, to the west by Black Riverand to the south is a section of the Buckhall road. Access to the project area, which is heavily forested, depends on the nature of what is being transported: (a) Personnel and Perishables; (b) Heavy Equipment; and (c) Light Equipment and fuel. The closest town is Bartica, some ~30km away to the southeast.

Personnel and perishables can be taken from Georgetown to Parika by road; then by river from Parika up the Essequibo to the project site. The area is also accessible by helicopter or small aircraft from either Timehri or Ogle to the Bartica airstrip, which is ~3-km due south -west on the Bartica - Potaro road, in the same direction as Bartica. The air strip is connected to the project site by roads and trails and the Karau pontoon crossing.

Heavy equipment can be transported by pontoon from Georgetown to the nearby Buckhall Landing and then by road and trials to the project site directly. Light equipment and fuel can be taken by road from Georgetown to Parika, then from Parika by boat or barge to Buckhall, then to the site. When wharfage is established in the project area, the pontoons will be able to dock and discharge/load directly at the project site.

Access within the boundaries of the prospect is relatively good; the previous logging operations within the area left a network of trails and lines throughout the proposed QL.

The proposed QL is dominated by sharp and steep hills with elevations reaching over 200 feet. The area is drained by a dendritic network of moderately incised small streams and creeks. The hills and ridges are elongated and oriented along with a dominant W-E structural trend. The high elevations carry relatively sharp and steep slopes as a result of underlying hard rock, which resists mass movement. The lower elevations are covered by fluviatile material. The Project area is veneered entirely by tropical lowland forest with the canopy height ranging from approximately 15m to 20m. Aside from tracks and trails made by small-scale artisanal loggers, the forest cover has essentially been preserved; only very selective logging practices were carried out in the area.

The area is currently undeveloped and uninhabited; there is no activity in the area presently - neither mining nor logging. Selective logging was previously done in this area. The larger general area is already designated as mining lands and has been allocated to several persons as a series of medium-scale prospecting permits for gold.

The climate in Guyana is strongly influenced by the Inter-tropical Convergence Zone (ICZ). Due to the movement of the ICZ, most climate variables show bimodality throughout the year. There

are two (2) wet seasons and two (2) dry seasons, and the dry season months have an average of more than 150 mm of rain per month. The long wet season occurs from May to August and a short wet season from December to February. The intervening months are drier, with October being the driest month. In November, low thermal pressure develops in the Amazon basin, causing air masses to flow into the basin, thus diminishing the effect of the normal air convergence of the ICZ. Therefore, the December rainy season is less pronounced. Rainfall in Guyana is greatly affected by the Pakaraima Mountains in the west and the Wilhelmina Mountains of Suriname in the east. As easterly winds prevail, orographic uplifts and subsequent condensation cause a high rainfall of 4400 mm on the eastern sides of the mountains. The annual rainfall decreases by 1700 mm on the western sides of the mountain.

Within the project area, which is characterized by a tropical rainforest climate, annual rainfall averages about 3000 mm. The temperature along the creek ranges from 29˚C to 31˚C; under the forest canopy, it is humid but cooler.

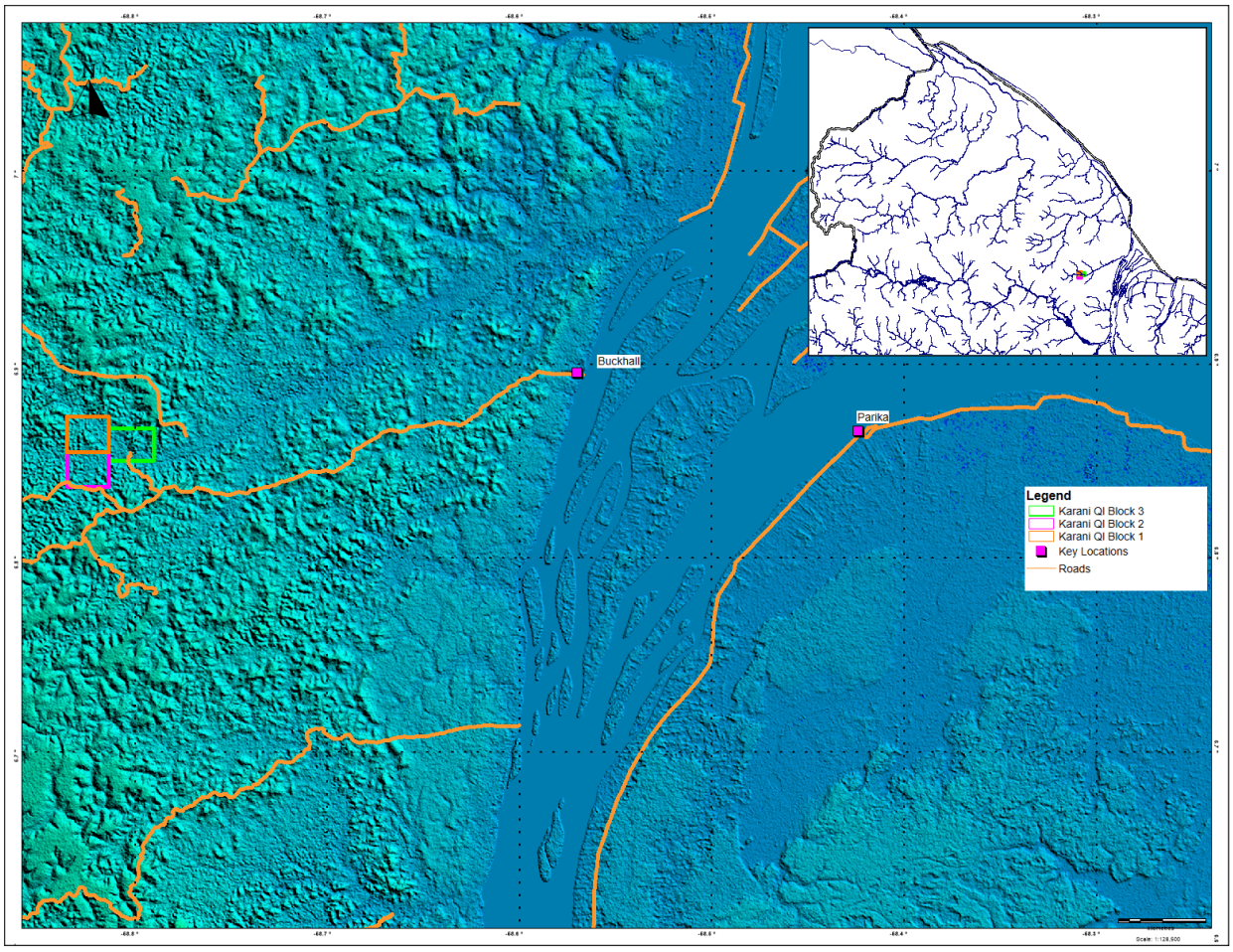


Figure 1. Location & Access with Physiography

3.0 Property Status & Description

3.1 Property Status

The Karani Quarry Project is a proposed MPs are designated Block 1,2 &3 that are being sought by from the Guyana Geology and Mines Commission (GGMC). A MP is issued for 5 years, with subsequent renewals being five years each or the life of the mine. The area being applied for is already allocated for mining by the GGMC. The area is presently surrounded by a series of medium-scale prospecting permits for gold. There are no active gold mining operations in the area, and the potential for significant gold occurrences is virtually non-existent. The MP carries a work performance bond which has to be lodged with the GGMC, and a fixed schedule of rental payments for the land, as well as several other reporting and performance requirements to keep the license in good standing.

3.2 Property Description

Block 1

A tract of state land located in the Cuyuni Mining District No. 4 as shown on Terra Surveys Topographic Map 19SE, at scale 1:50,000 with reference point 'X' located at geographical coordinates of Longitude **58° 49' 29.0856"W** and Latitude **6° 51' 50.1984"N**

Thence at a true bearing of **265.23º**, for a distance of **3 Miles 1600.7 yards**, to the point of commencement:
Point A, located at geographical coordinates of longitude **58° 50' 7.7244"W** and latitude **6° 51' 17.5536"N**, thence at true bearing of **99.18º**, for a distance of approximately **2580 yards**, to **Point B**, located at geographical coordinates of longitude **58° 48' 50.4648"W** and latitude **66° 51' 17.5536"N**, thence at true bearing of **9.18**, for a distance of approximately **2200 yards**, to **Point C**, located at geographical coordinates of longitude **58° 48' 50.4648"W** and latitude **6° 52' 23.3688" N**, thence at true bearing of **279.18º**, for a distance of approximately **2930 yards**, to **Point D**, located at geographical coordinates of longitude **58° 50' 7.7244" W** and latitude **6° 52' 23.3688"N**, thence at true bearing of **189.18º**, for a distance of approximately **2200 yards** to the point of commencement at **Point A.**

Thus enclosing an area of approximately **1189 acres**, save and except all lands lawfully held or occupied.

Block 2

A tract of state land located in the Cuyuni Mining District No. 4 as shown on Terra Surveys Topographic Map 19SE, at scale 1:50,000 with reference point 'X' located at geographical coordinates of Longitude **58° 49' 28.2072"W** and Latitude **6° 50' 46.9176"N**

Thence at a true bearing of **265.23º**, for a distance of **3 Miles 1600.7 yards**, to the point of commencement:
Point A, located at geographical coordinates of longitude **58° 50' 7.5048"W** and latitude **6° 50' 12.5484"N**, thence at true bearing of **99.18º**, for a distance of approximately **2580 yards**, to **Point B**, located at geographical coordinates of longitude **58° 48' 50.508"W** and **6° 50' 12.5484"N**, thence at true bearing of **9.18**, for a distance of approximately **2200 yards**, to **Point C**, located at geographical coordinates of longitude **58° 48' 50.4648"W** and latitude **6° 51' 17.5536"N**, thence at true bearing of **279.18º**, for a distance of approximately **2930 yards**, to **Point D**, located at geographical coordinates of longitude **58° 50' 7.7244"W** and latitude **6° 51' 17.5536"N**, thence at true bearing of **189.18º**, for a distance of approximately **2200 yards** to the point of commencement at **Point A.**

Thus enclosing an area of approximately **1174 acres**, save and except all lands lawfully held or occupied.

Block 3

A tract of state land located in the Cuyuni Mining District No. 4 as shown on Terra Surveys Topographic Map 19SE, at scale 1:50,000 with reference point 'X' located at geographical coordinates of Longitude **58° 48' 9.378"W** and Latitude **6° 51' 32.9868"N**

Thence at a true bearing of **265.23º**, for a distance of **3 Miles 1600.7 yards**, to the point of commencement:
Point A, located at geographical coordinates of longitude **58° 48' 50.4828"**and latitude **6° 51' 1.2276"N**, thence at true bearing of **99.18º**, for a distance of approximately **2580 yards**, to **Point B**, located at geographical coordinates of longitude **58° 47' 25.728"W** and latitude **6° 51' 0.7884"N**, thence at true bearing of **9.18**, for a distance of approximately **2200 yards**, to **Point C**, located at geographical coordinates of longitude **58° 47' 26.1312" W** and latitude **6° 52' 1.902"N**, thence at true bearing of **279.18º**, for a distance of approximately **2930 yards**, to **Point D**, located at geographical coordinates of longitude **58° 48' 50.4828" W** and latitude **6° 52' 1.902" N**, thence at true bearing of **189.18º**, for a distance of approximately **2200 yards** to the point of commencement at **Point A.**

Thus enclosing an area of approximately **1198 acres**, save and except all lands lawfully held or occupied.

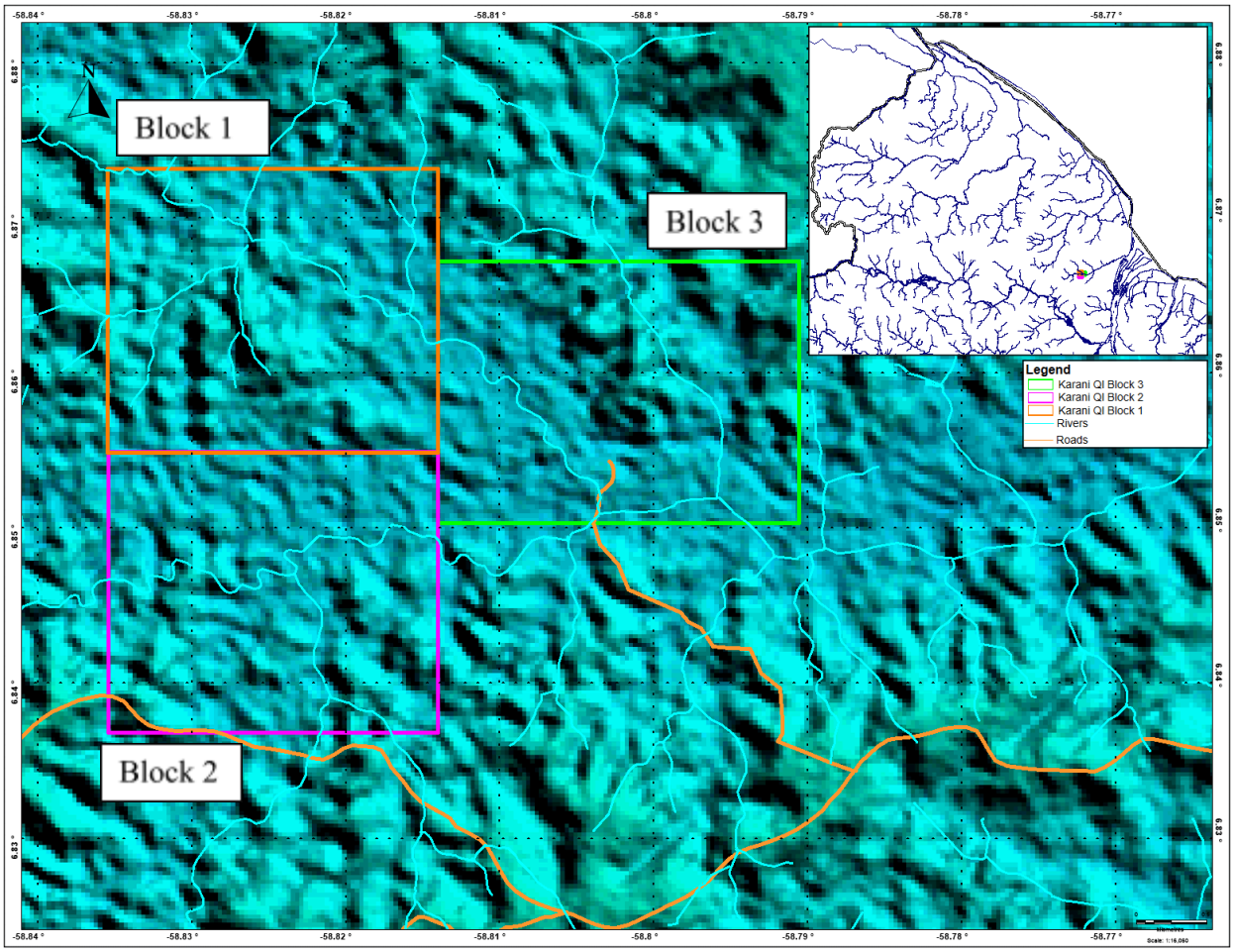


Figure 2. Property Status

4.0 Previous Work

The only resources estimate available at this time is from work done by H. Schielly in 1968. According to him, the nearby Rock Point quarry area has reserves of 150,000 tonnes. The proposed QL encloses an area of 1,173 acres which is dominated by topographic highs that are roughly four times those of the Rock Point quarry area. Also, the morphology of these high areas indicates that they are most likely related to the regional E-W trending intrusions that pass through the entire area. These intrusions are prime sources of material for aggregate production. Based on these facts and other supporting data, it would be reasonable to expect a reserve of approximately 2,000,000 tons. This will be verified and quantified by comprehensive drilling after operations have been established in the project site.

5.0 Geology

5.1 Regional Geology

Guyana is located on the northeast coast of South America and is entirely comprised or underlain by the Precambrian Guiana Shield rocks. The Guiana Shield lies between the Orinoco and Amazon Rivers and encompasses all or portions of neighboring countries Suriname, French Guiana, Venezuela, Brazil, and Columbia, aggregating to an area of 1.6 million km2.

The Guiana Shield and cover sequences comprise the following principal stratigraphic successions (Figure 3).

● The Imataca Complex, an Archaean complex composed of 3.4Ga - 2.7Ga protolith, is superimposed high-grade metamorphic rocks of Trans-Amazonian age (2.2Ga - 2.0Ga) exposed in the Ciudad Bolivar region of Venezuela.

● High-grade granulites and gneisses of the Central Guyana Granulite Belt of Palaeoproterozoic age (2.4Ga - 2.3Ga).

● A widely developed Palaeoproterozoic granite-greenstone succession, which was deformed and metamorphosed during the Trans-Amazonian tectono-thermal event (2.2Ga - 2.0Ga). The Trans-Amazonian age rocks stretch across much of the northern third of the shield, incorporating a succession of older gneissic granitoid. The two principal occurrences in Guyana are referred to as the Bartica Gneiss and Kanuku Group. These gneissic complexes are considered equivalent to the Cape Coast Suite of West Africa. They are enveloped by a less deformed succession of basic to acid volcanics, sediments, and syntectonic granitoids. In Guyana, the greenstones are referred to as the Barama-Mazaruni Supergroup, in Venezuela the Pastora Supergroup, while in Surinam and French Guiana, the term Maroni Supergroup is used. The greenstones are intruded by syntectonic granitoids (2.25Ga - 2.0Ga) equivalent to the Dixcove Suite of West Africa, providing an upper age limit Trans-Amazonian Orogeny, similar to that recorded for the Eburnean Orogeny of West Africa.

● The Uatuma Supergroup comprises a mostly undeformed and unmetamorphosed Mesoproterozoic (1.9Ga - 1.5Ga) sequence of supracrustals deposited above a major regional unconformity with the underlying Palaeoproterozoic basement. From oldest to youngest, these include 1,000m - 1,600m thick continental sandstones and conglomerates of the Muruwa Formation and the 1,000m - 2,000m thick felsic volcanics, terrigenous sediments, and sub-volcanic intrusives comprising the Iwokrama Formation.

● The Uatuma Supergroup is unconformably overlain by the topographically distinctive Roraima Group, which forms the Pakaraima Plateau bounded by a near-vertical escarpment. The Roraima Group comprises a 1,000 – 3,600m thick sequence of relatively flat-lying, unaltered conglomerates and sandstones with subordinate siltstones and felsic volcanics. The underlying basement and mafic intrusives constrain the age of the Roraima to between 1.9Ga - 1.6Ga.

● Intruding the Roraima and Trans-Amazonian basements are dykes and sills of gabbro and dolerite of the Avanero Suite. These intrusives are typical of substantial thickness and may extend laterally for hundreds of kilometers. The Avanavero Suite intrusives are undeformed and unmetamorphosed. Ages of the Avanavero suite have been determined by radiometric dating to 1.84Ga - 1.61Ga with the main cluster at 1.78 Ga.

● Other basic intrusives, younger than the Avanero Suite, cluster at ages of 1330, 1213, 907, 700-570, and 430-500 million years before. These dykes are designated the PAPA dykes, an acronym standing for Post-Avanero Pre-Apaotoe.

● Opening of the Atlantic during the Mesozoic resulted in the formation of intracratonic rifts within the Guiana Shield, filled with basaltic lavas and terrestrial sediments. In Guyana, these Mesozoic rifts are represented by the Takutu Graben, an east-northeast trending rift structure, and the mostly offshore Guyana coastal basin.

● Associated with the opening of the Atlantic Rift was the emplacement of the dyke swarms known as the Apatoe Suite. Dykes of this suite are typically narrow, fine-grained doleritic dykes of great strike extent, predominantly trend north-northeast to the east-northeast.

● Quaternary to Recent sediments of the Corentyne Group veneer much of the basement geology in northern Guyana. Clean, shallow marine to estuarine quartz sands of the Berbice Formation (also referred to as the Mackenzie or White Sand Formation) are most prevalent, increasingly overlain by reducing fluviatile clays of the Demerara Formation towards the northern coast

The Guiana Shield has been correlated with the Leo-Man Shield of West Africa. It is generally accepted that before the opening of the Atlantic during the Mesozoic, the two shields formed a contiguous craton. The Archaean Imataca Complex can be correlated with the Archaean Liberian Province, the Central Guyana Granulite Belt with the Dimbroko Zone in Ivory Coast, the Barama-Mazaruni greenstones with the Birimian greenstones, and the Trans-Amazonian tectono-thermal event with the Eburnean Orogeny.

The proposed Quarry Mine is located in the Archean-Proterozoic Guiana Shield in northeast South America. The Guiana Shield is a palaeo-Proterozoic granite-greenstone terrane and is considered to be the extension of the West-African palaeo-Proterozoic Birimian Supergroup terrane. The Guiana Shield is primarily composed of the Barama-Mazaruni Supergroup, a metasedimentary/greenstone terrane intercalated with Archean-Proterozoic gneisses are intruded by Trans-Amazonian granites, as well as mafic and ultramafic rocks (McConnell and Williams, 1969).

The Barama Group consists of pelitic metasedimentary and metavolcanic rocks. The Mazaruni Group conformably overlies the Barama Group, which also consists of metasedimentary and metavolcanic rocks. The Mazaruni Group is subdivided into the Cuyuni Formation and the Haimaraka Formation.

The Cuyuni Formation consists of pebbly sandstone and an intraformational conglomerate, intercalated with felsic to mafic volcanic rock. The Haimaraka Formation conformably overlies the Cuyuni Formation and consists of a thick sequence of mudstone, pelite, and graywacke; significant volcanic rock is absent from this unit (McConnell and Williams, 1969).

The Barama-Mazaruni Supergroup was formed within a geosynclinal basin locally bordered by an Archean continental foreland. The Trans-Amazonian Orogeny, approximately 2 Ga, resulted in block faulting, crustal shortening, folding, metamorphism, and anatexis of the Barama-Mazaruni Supergroup (Hurley et al., 1967).

The regional metamorphic grade of the Barama-Mazaruni Supergroup is generally lower to middle greenschist facies. Near the contact of some of the larger granitic complexes, the Barama-Mazaruni Supergroup is metamorphosed from upper greenschist to amphibolite facies.

Syn- to late-Tectonic calc-alkaline to intermediate intrusive rocks, collectively known as the Trans-Amazonian Granitoids (Voicu et al., 1999), were emplaced the Trans-Amazonian Orogeny, between 2.25 and 1.96 Ga, (Gibbs and Barron, 1993). They range in composition from granite to granodiorite, diorite, and adamellite.

The project site is located in the Trans-Amazon province of the Guiana Shield, part of the Amazonian Craton (Teixeira et al., 1989).

The Trans-Amazonian province is a granitoid-greenstone terrane generated between 2.25 and 2.00 Ga (Gibbs and Olszewski, 1982; Cox et a;., 1993, Santos et al., 2000), whose structural trends broadly parallels the Atlantic coast from Venezuela, through the Guianas to Amapa state in Brazil.

In Guyana, the rocks of the region, collectively known as the Barama-Mazaruni Supergroup, are Paleoproterozoic in age and comprise an east-west trending series of a series of mafic through felsic volcanic flows with intercalated clastic sediments (Gibbs, 1980; Gibbs and Barron, 1993).

Their strata were deformed by the Trans-Amazon Tectonothermal Episode (2.1-2.0 Ga). They were subsequently intruded by granite intrusions known as the Younger Granite Group (about 1945 Ma), which probably were emplaced coevally with a regional sub-greenschist facies metamorphic event (Williams et al., 1967).

Mafic dykes belonging to the Younger Basic Group or Avanavero Suite. (1.78 Ga) cut the metamorphosed rocks. The Northern Guyana Metallogenic Province, which includes the Barama-Mazaruni Supergroup, is the principal metallogenic province of Guyana. The overall distribution of gold occurrences in the Northern Guyana Metallogenic Province is controlled by structural breaks (Walrond, 1981)

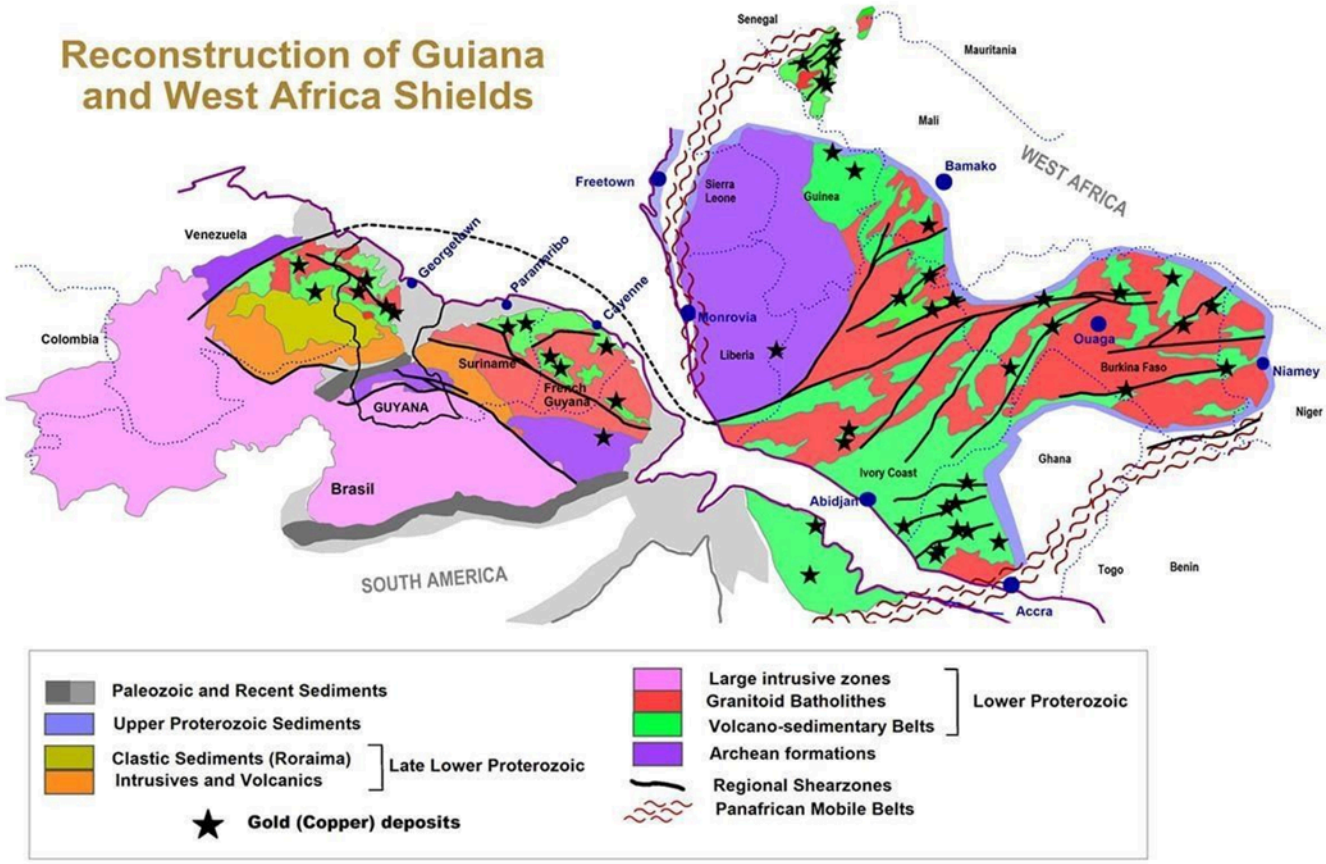


Figure 3. Showing regional geology of the area (Keriti Quarry located in red circle)

5.2 Local Geology

The local geology of the area has three distinct lithologies; Bartica Gneiss Complex, Younger Granites, Metavolcanics, and metabasic rocks (Figure 4).

Barama Mazaruni Supergroup

Most of the project area is underlain by the Lower Proterozoic (>2.2 Ga) Barama-Mazaruni Supergroup vocanosedimentary sequence. A general succession from lower volcanic to upper volcaniclastic sedimentary rocks is typical of this sequence. Basalt units predominate in the lower parts of the volcanic sections, and they are interstratified with andesite, dacite and rhyolite in the middle and upper sections. Tuff, redeposited tuff, greywacke shale, and less abundant chemical sedimentary rocks (chert, carbonate, Fe, Mn, C, and S-rich sedimentary rocks) are interstratified with the volcanic rocks, with greywacke and shale as the dominant rock types in the upper parts of the sections

Younger Granites

Large areas consisting predominantly of granite occur, but as topography is subdued, most evidence is derived from isolated boulders of granitic rocks in swamps. Some authors (e.g. Allen 1963) have attempted to separate batholiths into separate rock types, but not enough outcrop is present in this area to support this. In some areas a dioritic phase appears to be a separately mappable unit, partly as it shows up on aeromagnetic data. The presence of adamellites, tonalites and graphic alkali granites within a few kilometres of each other suggests that not all granites are part of the same intrusion, and that composite intrusions are present.

Some of the granitic rocks are particularly difficult to categorise. Historical work by Hawkes (1961) and Schielly (1967) suggested that banded granitic rocks in this area were gneisses. Hawkes argued that these were the equivalent to the Bartica Formation (thought to be the metamorphosed equivalent of Mazaruni Group), while Schielly suggested that the gneissose rocks were an older basement on which the Mazaruni Group was deposited. Petrological investigation of samples from this project, and the adjacent Kartuni area suggests that many of the banded rocks in the field are in fact syn- tectonic granites, with rocks intruded during a phase of faulting or ductile deformation. One particular point of evidence is that some of these banded granitic rocks contain magmatic epidote, and in some cases also contain magmatic allanite (a rare earth rich epidote), within crystals of magmatic epidote. These minerals are not only clear evidence that the rocks crystalised from a magma, but also that these granites crystalised at high pressures at the base of the continental crust. A number of authors (e.g. Dawes & Evans 1991) suggest that magmatic epidote is only stable at pressures over 8kb (approx 30km depth). In normal continental crust the Moho is thought to be at approximately 35km. Assay results show that granites also contain high Rb and Sr (see below), also considered evidence of deep crustal formation. On the geological map an attempt has been made to distinguish between gneissose granites and equigranular granites, but in reality they probably grade into each other, with banded varieties presumably closer to the margins of the intrusions.

Intermediate meta-volcanics.

One of the more common outcrop types exposed in this area consists of calc-alkaline andesitic greenstones, and basaltic andesites, often porphyritic. Some of these rocks appear to be vesicular, and may be pillow basalts. Rare interbedded cherty rocks have been found. Coarser rocks include agglomerates or welded breccias, and some welded andesitic tuffs have also been found.

Meta-basic rocks.

Meta-basalts, dolerites and meta-gabbros occur in several parts of the field area, usually in the areas with higher laterite capped hills. Work in other areas of Guyana (Gibbs & Barron 1993) suggests that such rocks form the lower part of the greenstones of the Barama-Mazaruni Supergroup, and minor interbedded siliceous meta-sediments (e.g. cherts and siltstones) and basaltic tuffs are also present. Such rocks are thought to grade upwards to more andesitic volcanics. One possibility is that this is part of an ophiolite suite. In the Upper Kartuni meta-diorites have been recognised intruding into this unit.

One problem rock type is dolerite with evidence of hydrothermal alteration. Generally such rocks have been "lumped" with the meta-basic rocks on the supposition that the mineral assemblage seen under low levels of metamorphism can be very similar to hydrothermal alteration. Alternatively altered basic rocks may be part of an older basic suite similar to that seen further north in the Kartuni area.

In areas with a higher metamorphic grade, amphibolites appear to be the equivalent of this meta-basic unit. Amphibolites are often seen in areas marginal to granitic intrusions. Generally the amphibolites are less magnetic, and do not show up as well on the aeromagnetic map.

In that area, distinct gneisses are present but occur in narrow zones within a belt of syntectonic granites with amphibolitic xenoliths and amphibolite slivers. It consists of various ortho and paragneisses and amphibolites, generally metamorphosed in the almandine amphibolite facies.

Schielly describes the material within the mine area as heavily jointed, foliated, hornblende-biotite gneiss with granite and pegmatite dykes, and even if fractured moderately, still carries good characteristics for the following utilization:

1. It is suitable for first-class concrete aggregate
2. It is suitable for road foundation works and other foundation and fill applications
3. Large boulders and armor layer material for use in sea defenses

The suitability for utilization of the other rocks originating from the Bartica - Gneiss complex will depend on the extent to which it may have been deformed/metamorphosed/foliated and will be determined upon further investigation.

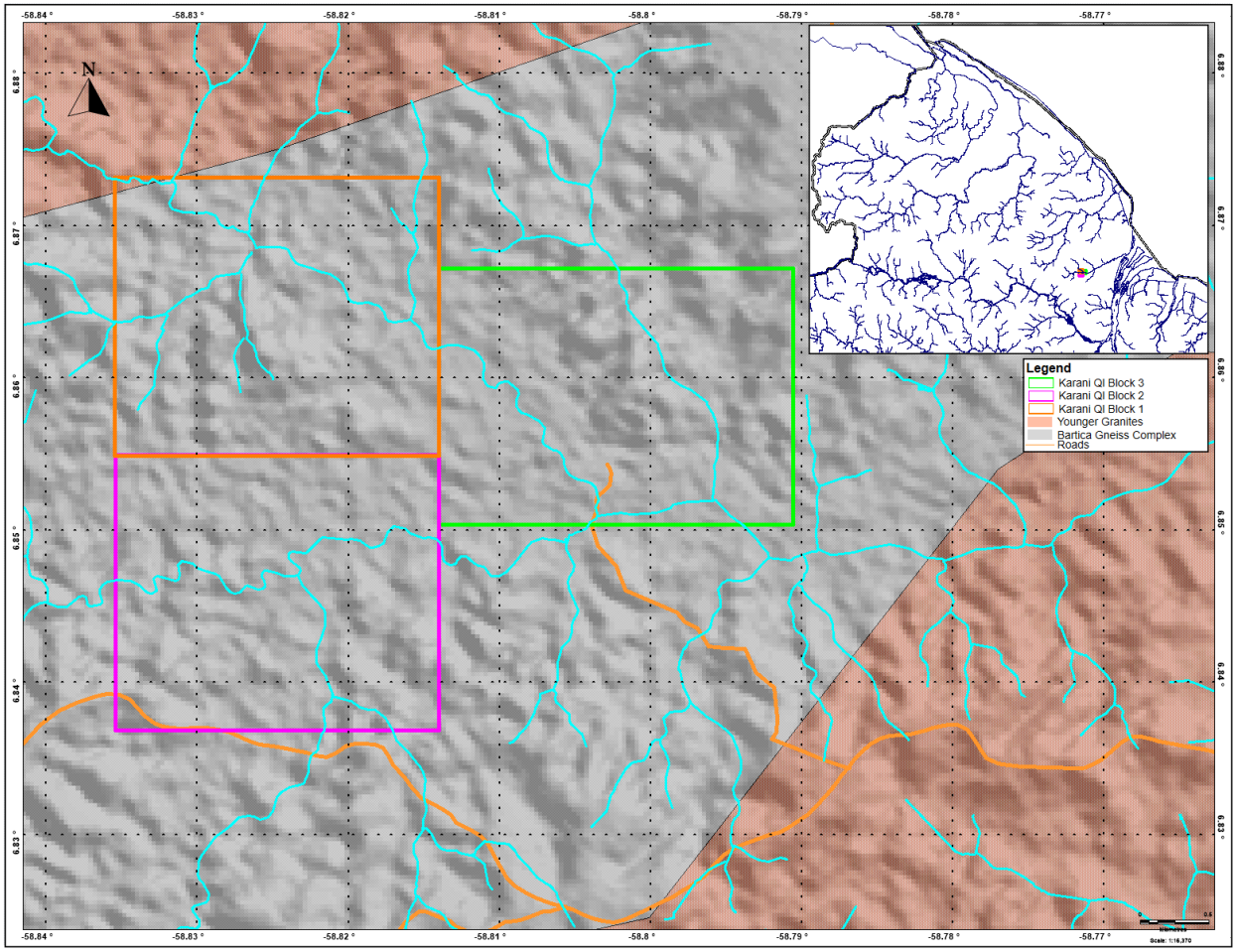


Figure 4. Showing the local Geology of the Area

6.0 Regional Structures

The boundary between the Imataca Complex and the Barama-Mazaruni Supergroup in Guyana is represented by the Guri Faults, which collectively comprise a distinct linear east-northeast trending crustal break.

The greenstone belts of the Barama-Mazaruni Supergroup are strongly deformed, with at least two episodes of tectonism evident in many areas. The metamorphic grade of the greenstone succession is typically greenschist facies, but may reach amphibolite facies close to belt margins and granitoids.

The Muruwa and Iwokrama Formations of the Uatuma Supergroup are weakly deformed, typically comprising broad open folds.

Several large-scale ductile shear zones have been documented in the Guiana Shield. In north central Venezuela, the most outstanding structure documented to date, the NE-SW trending Guri Fault, juxtaposes the Archean Imataca complex against Paleoproterozoic terranes. The Central Guiana Shear Zone (CGSZ) extends from French Guiana westerly towards central Suriname and further west towards north central Guyana, where it coincides with the Makapa-Kuribrong Shear Zone (MKSZ). In French Guiana, the North Guiana Trough (NGT) is interpreted as a sinistral strike-slip formed during the Trans-Amazonian orogeny.

Proto-Atlantic shear may be a Paleoproterozoic break reactivated during the opening of the Atlantic in the middle Mesozoic. The NGT occurs only in northern French Guiana and has transpressional kinematics (Milesi et al., 1995). The CGSZ is interpreted to follow a WNW-ESE direction across central French Guiana and extend laterally across central Suriname to continue further west in the direction of Northcentral Guyana, where it connects with the MKSK.

The Central Guiana Shear Zone (CGSZ), located in northern Guyana, comprises a series of major northwest-southeast striking shear zones contained within a 75-100-kilometer-wide belt (Voicu et al., 2001). These structures are spatially associated with many of the known mineral deposits in Guyana. The northwest-southeast lineament bounding the northern part of the Pakaramima Mountains to the west of Eagle Mountain is interpreted to be one of the more southerly strands of the Central Guiana Shear Zone.

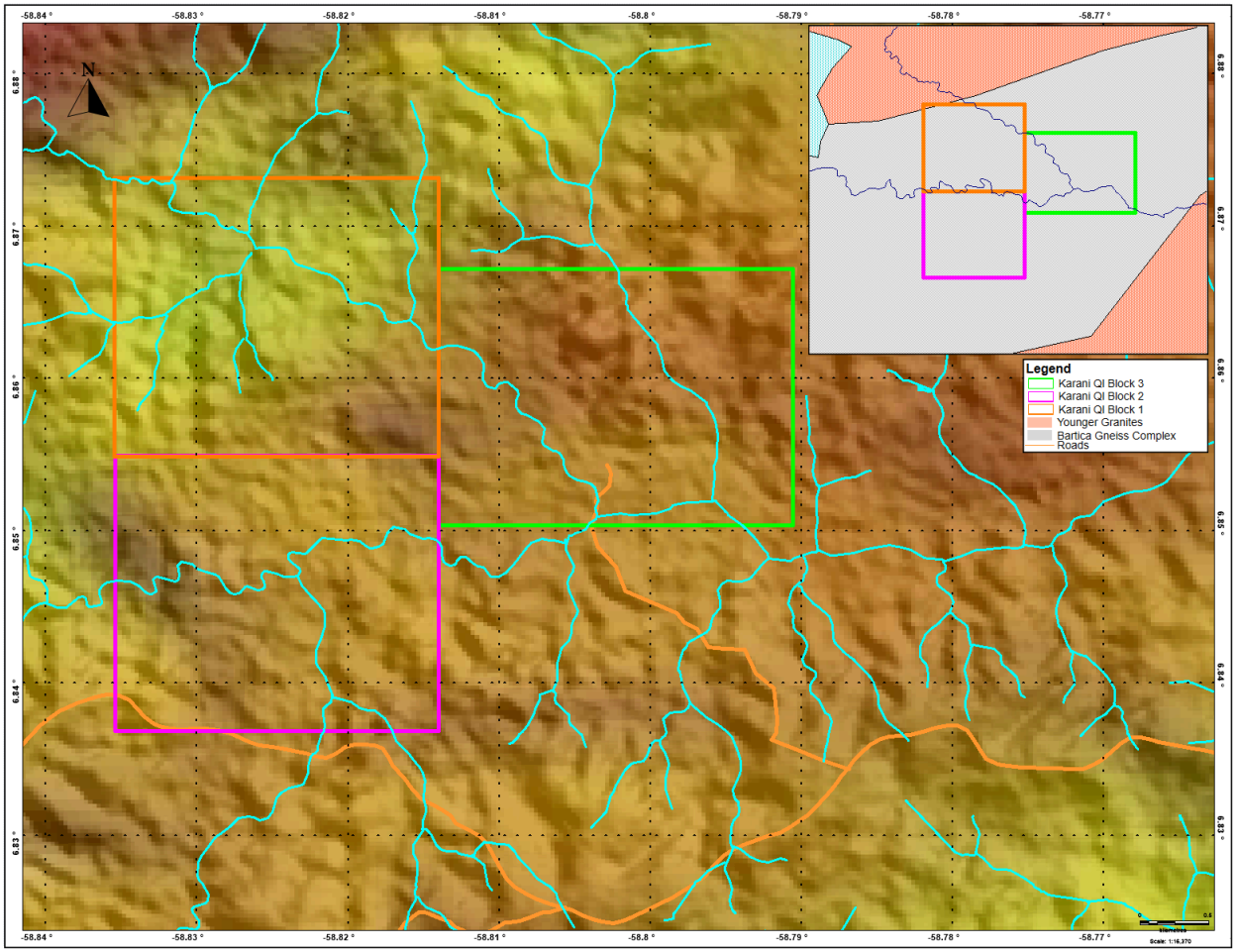


Figure 5. Aeromagnetic map of the area

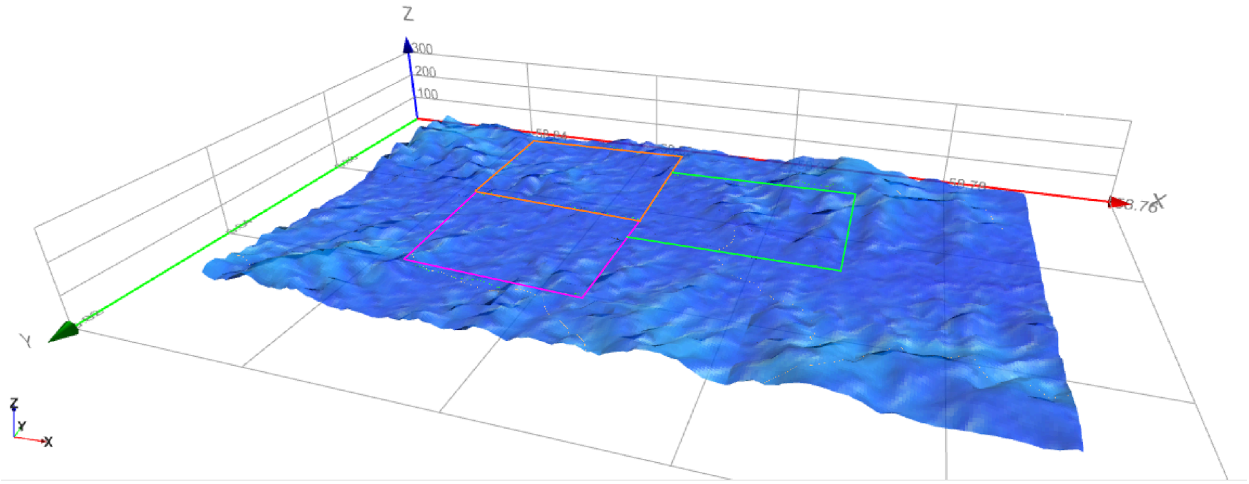


Figure 6. 3D render of the topography of the property

7.0 Resource Estimation for Proposed Mining Program 2021-2026

The Quarry Potential is calculated using the cut and fill method generated by the global mapper software and the srtm data (Figure 7). Figure 6 shows the 3D representation of the physical land configuration. Using this information and catering for 20% overburden, along with Granite's specific gravity, an inferred estimate of tonnage can be calculated.

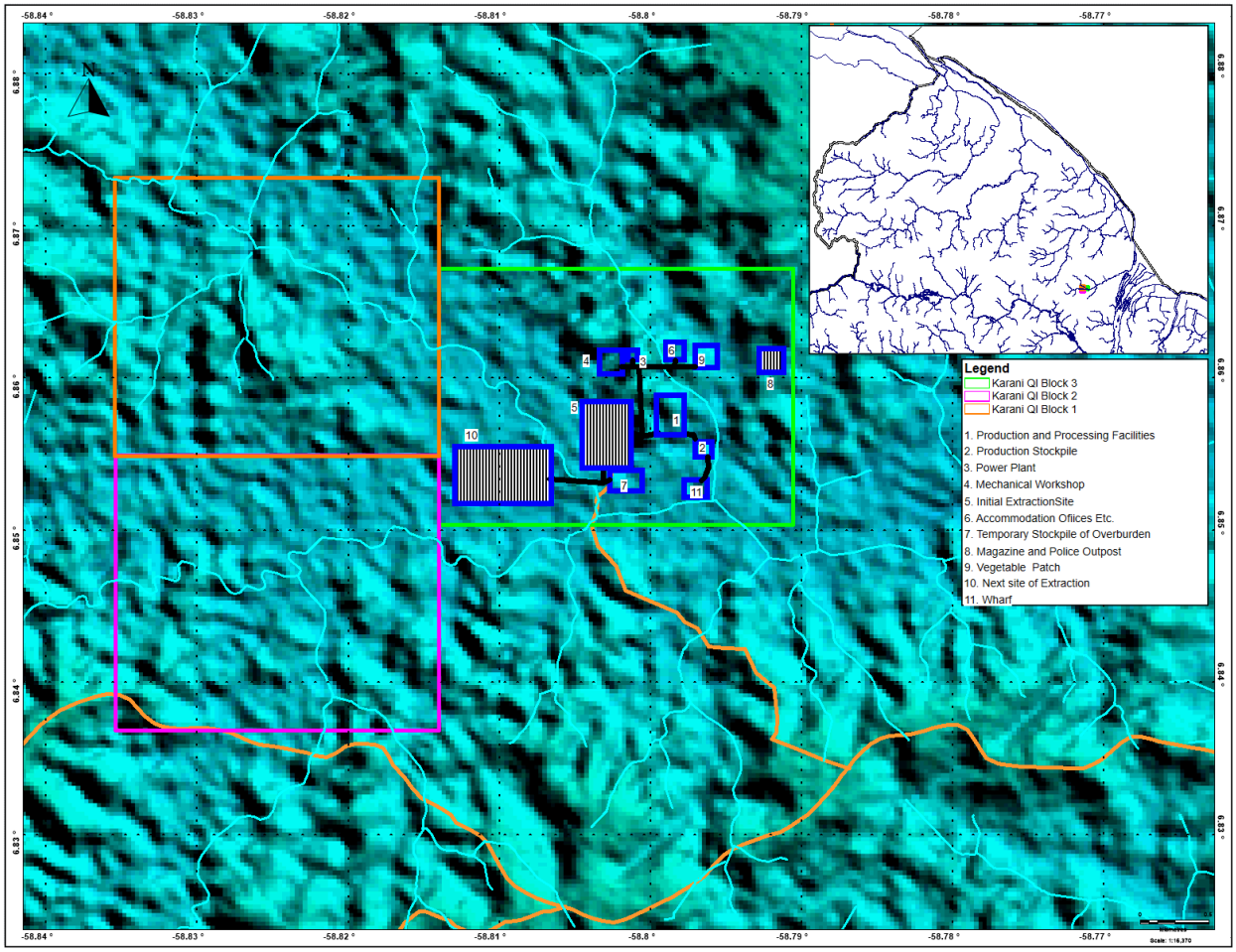


Figure 7. Location of Proposed Mine Site

The Quarry Potential is calculated using the cut and fill method generated by the global mapper software and the SRTM data. Using this information and catering for 20% overburden, along with Granite specific gravity, an inferred estimate of tonnage can be calculated. The quarry pits general locations are 58.687W 6.559N and 58.698W 6.557N; these cover 43.11 acres and 92.83 acres, respectively. Volumetric calculations were based on the on-site visit, the extent of the ore body seen and assuming geological continuity based on the structure's geological interpretation. From the outcrops seen, the geologist can safely make a preliminary modle based on the aeromagnetic interpretation and site visit. These values are used to determine resource estimation based on the rocks' specific gravity of Granite.

Property	Volume	S.G	Overburden	Estimated Reserves
Pit 1	415,078.39	2.5	20%	830,156.78
Pit 2	503,037.50	2.5	20%	1,006,075.00
Total	**415,078.39**	**2.50**	**0.20**	**1,836,231.78**

Table 1. Resource Estimation for Mining Pit

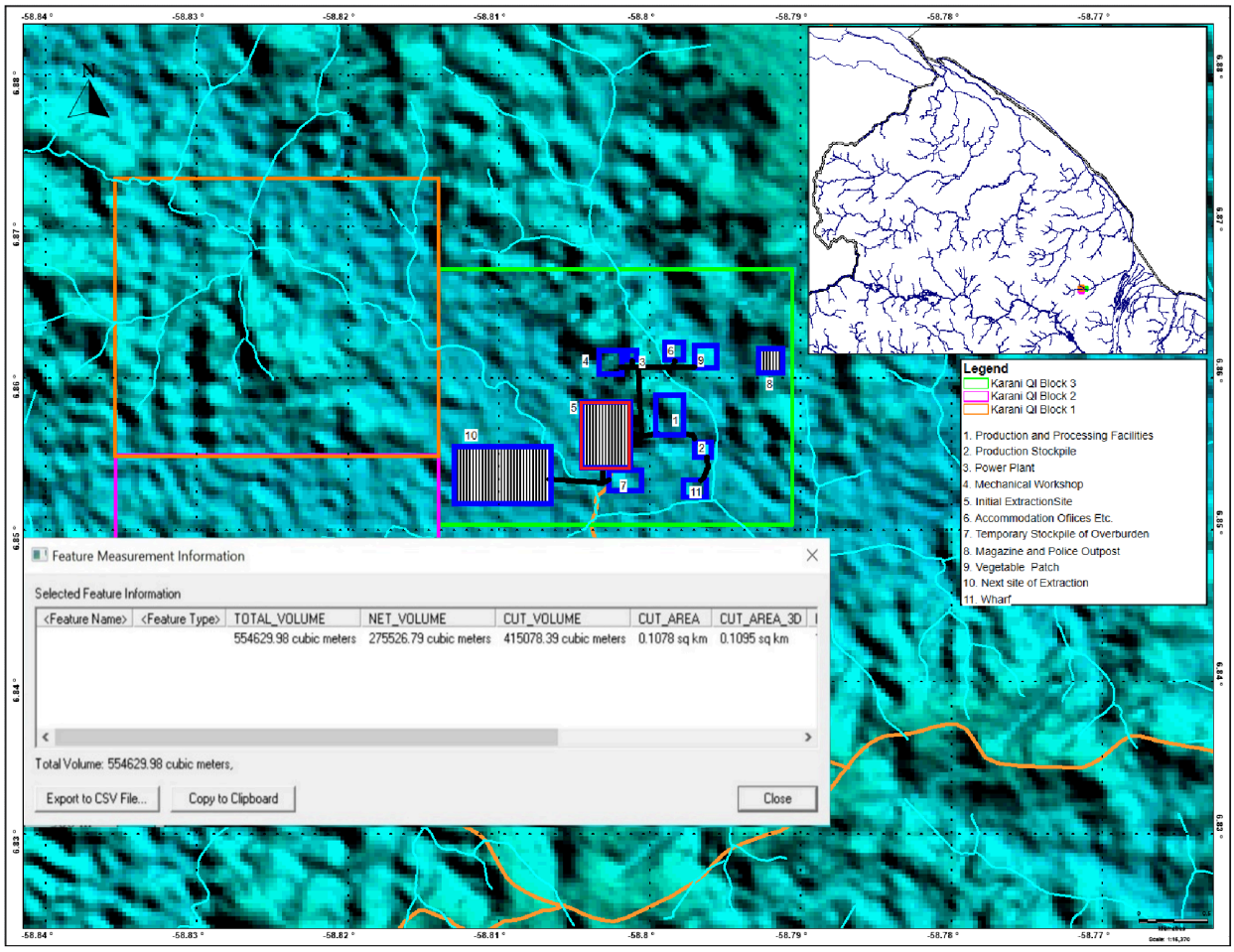


Figure 8. Volume Estimation using SRTM data for Pit 1

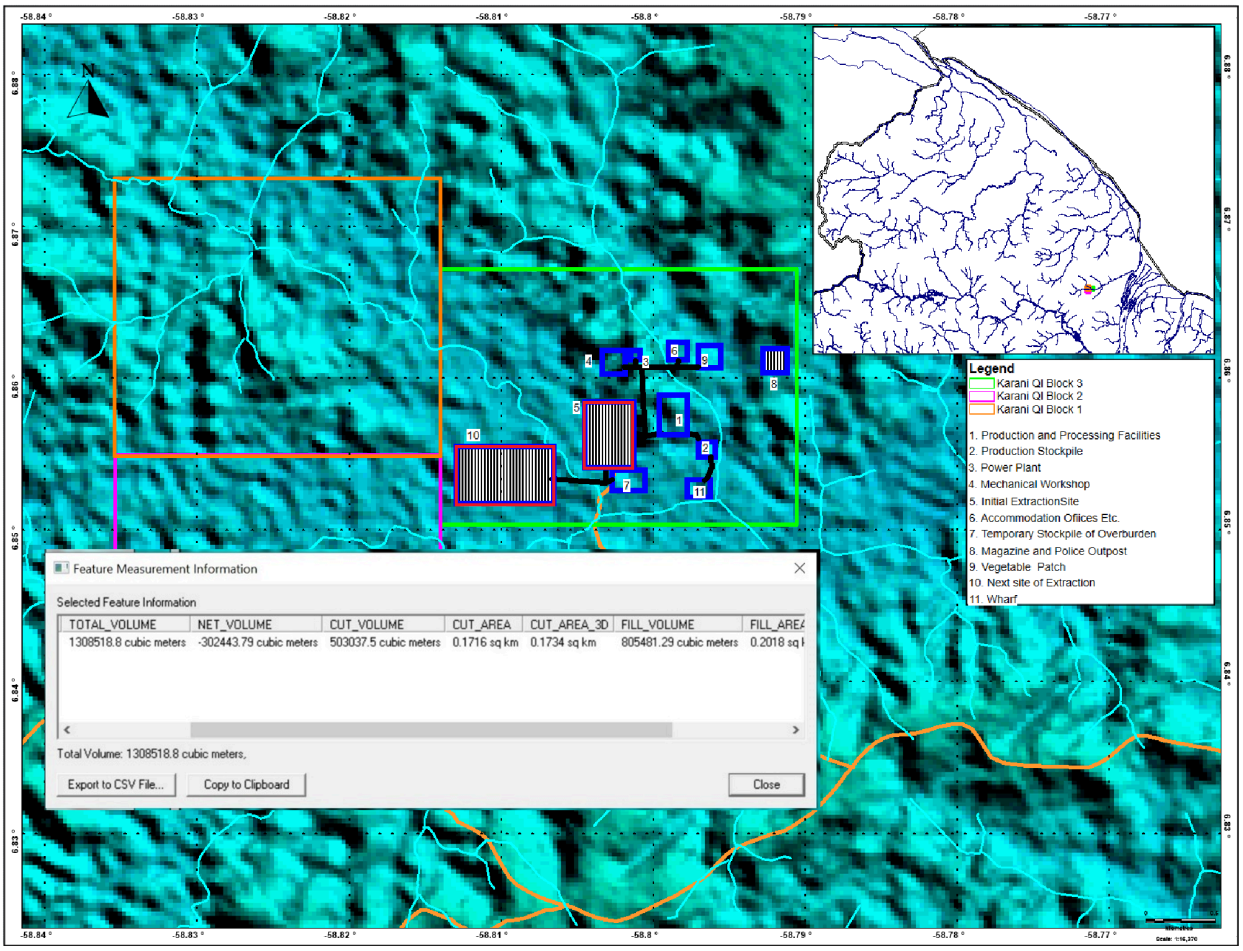


Figure 9. Volume Estimation using SRTM data for Pit 2

8.0 Proposed Mine Plan activities

For this project, it is estimated that appriximately 330,000 tons of rock will be produced per year for the first established production phase. The annual production for the first few years during the consolidation of operations will be 330,000 tons of aggregate and boulders. After the recovery of a substantial portion of the capital investment, the second phase of investment and expansion will increase production. The quarry will see a capital investment of not less than USD 3,500,000 and will have an initial workforce of at least 30 (local) employees. Development of this quarrying complex's facilities will be completed within 9 to 15 months of the License being granted

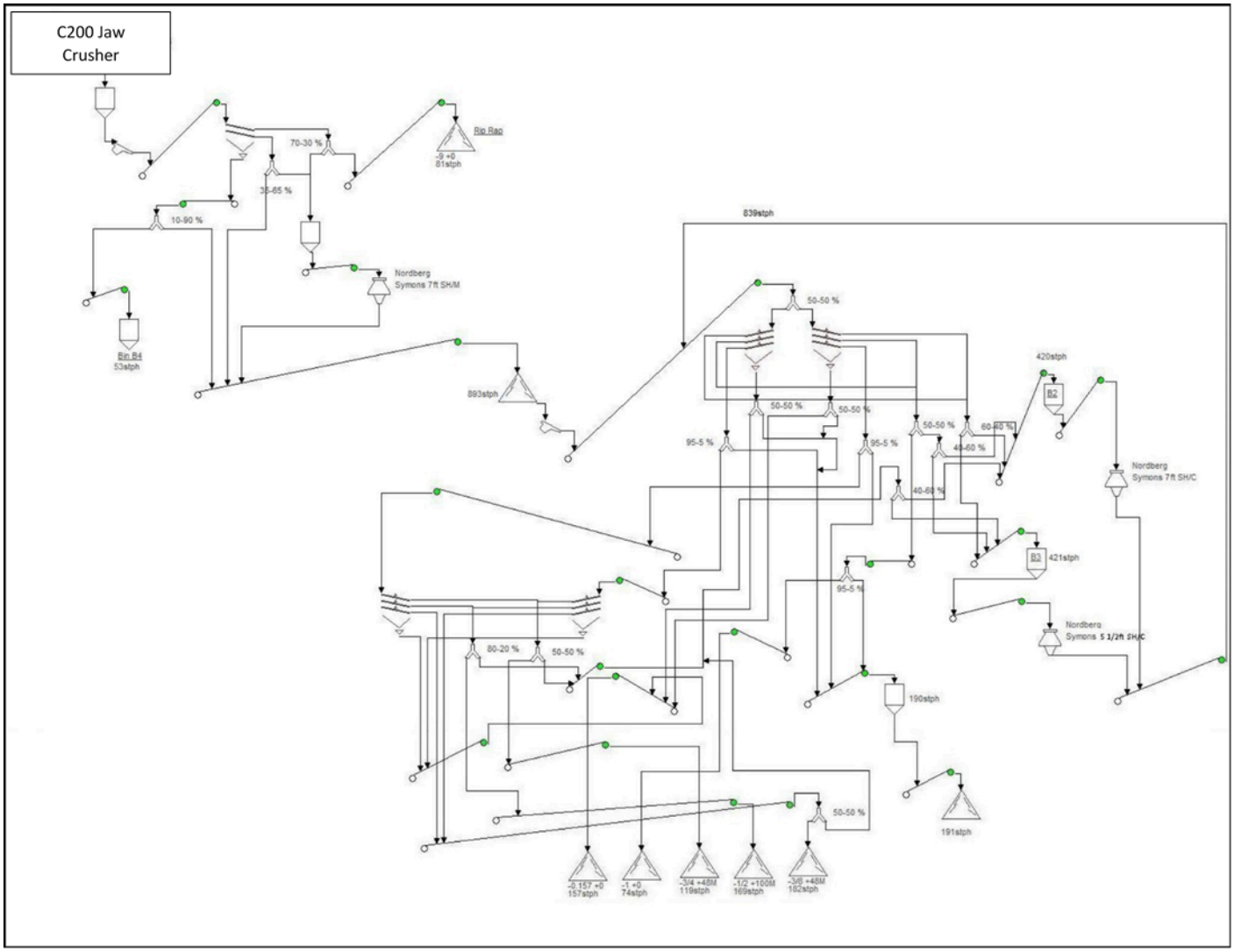


Figure 10. Design Flow of Proposed Mine Plan

QUARRY PLAN 2021-2026

START DATE	END DATE	DESCRIPTION	DURATION (days)
8/1/21	3/31/22	Development of Roads	240
8/1/21	2/28/22	Dev. of Mobile Crushing Unit	207
8/1/21	1/31/22	Dev. Of Stockpile & Dump site	180
8/1/21	12/31/22	Development of facilities	510
8/1/21	12/31/23	Resource Model Dev.	870
8/1/21	12/31/26	Development of Quarry	1950
1/5/22	12/31/26	Aggregate Production	1796
10/1/21	3/31/22	Set up of Explosive Bond and Police outpost	180
9/1/22	1/1/25	Expansion of Infrastructure	840
3/1/24	3/31/26	Development of new sites	750
6/1/24	12/31/26	New Haulage Roads	930

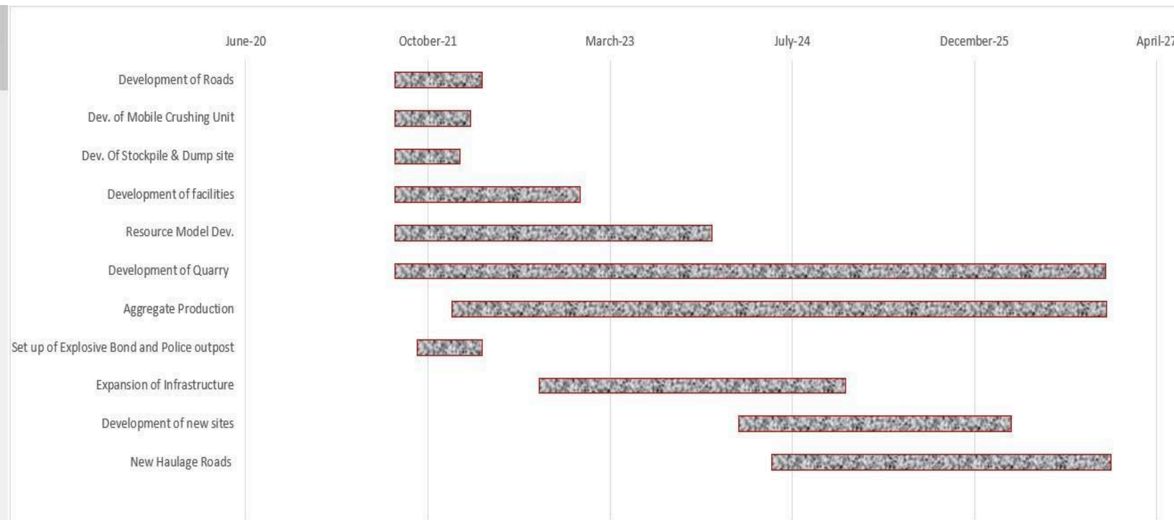


Figure 11. Gant Chart of Scheduled Activities

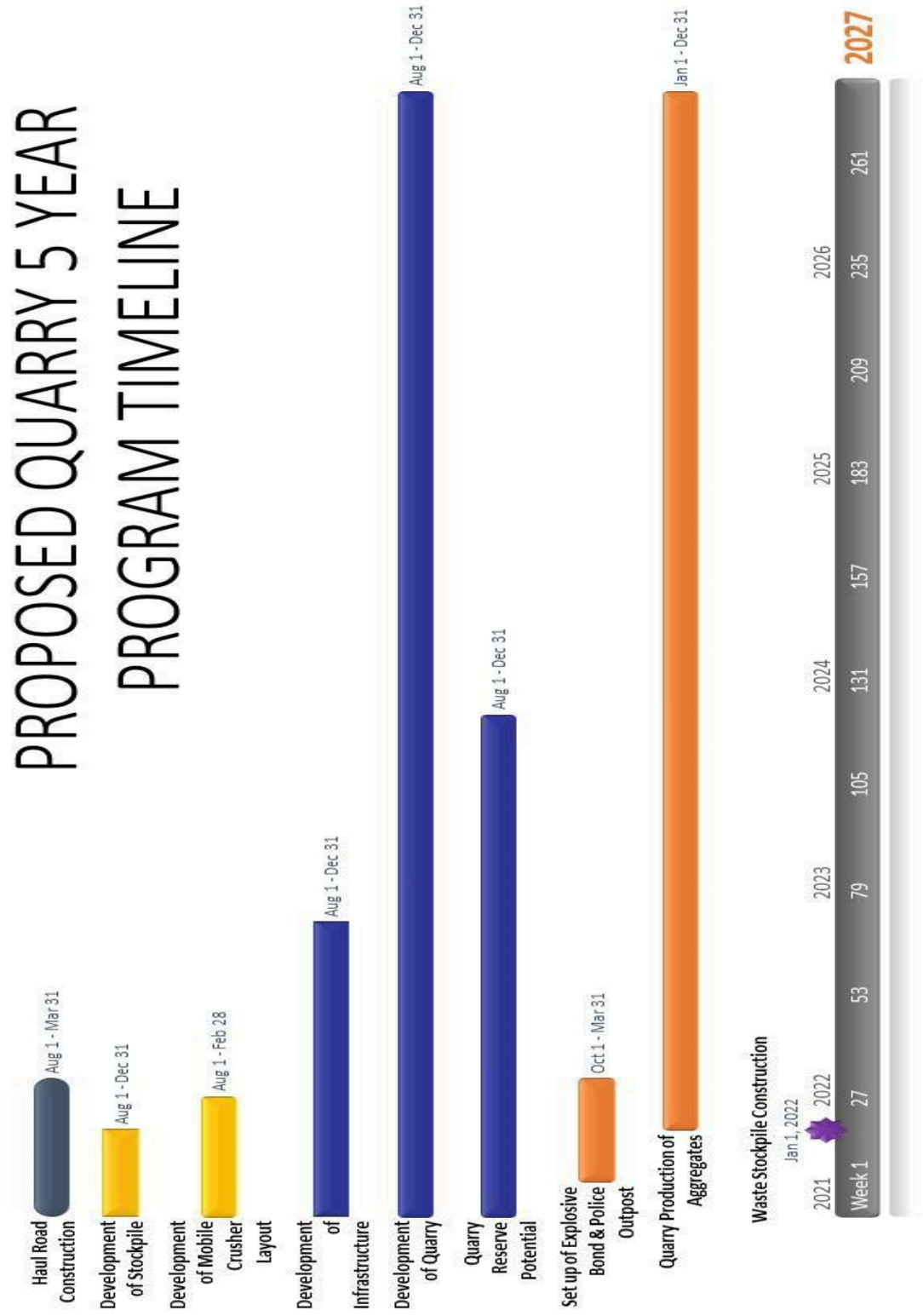


Figure 12. Karani Quarry 2022-2027 Mine plan Timeline

9.0 Proposed Open Pit Mine Schematics and Estimate Production

Karani Quarry has planned all its work activities for the next five years. This quarry intends to supply boulders, gabions, and crushed aggregates in the following fractions 7/8”, 3/4”, 5/8”, 1/2”, 1/4” minus, sifting, and quarry cleaning. Based on the volumetric calculations, the total tonnage of each pit was calculated. Based on the Pit production timeline, a total of quarriable material for each year was determined by the percentage of time (months of production for that fiscal year) multiply by the pit's total tonnage. Besides, the various size fractions production was also predetermined by the supply and demand of the market. Using all this information, a quarry resource estimate was made and estimated production of quarriable material from the proposed Quarry. A total of 1.6 million tons of gabbroic material and gabbroic material is available for road construction, sea defenses, and aggregates (Table 2).

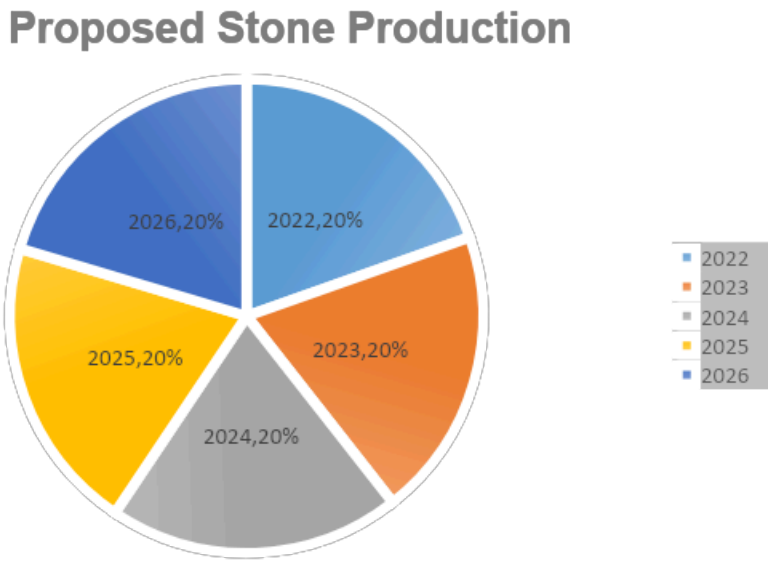


Figure 13. Chart showing how much stone to be produced yearly

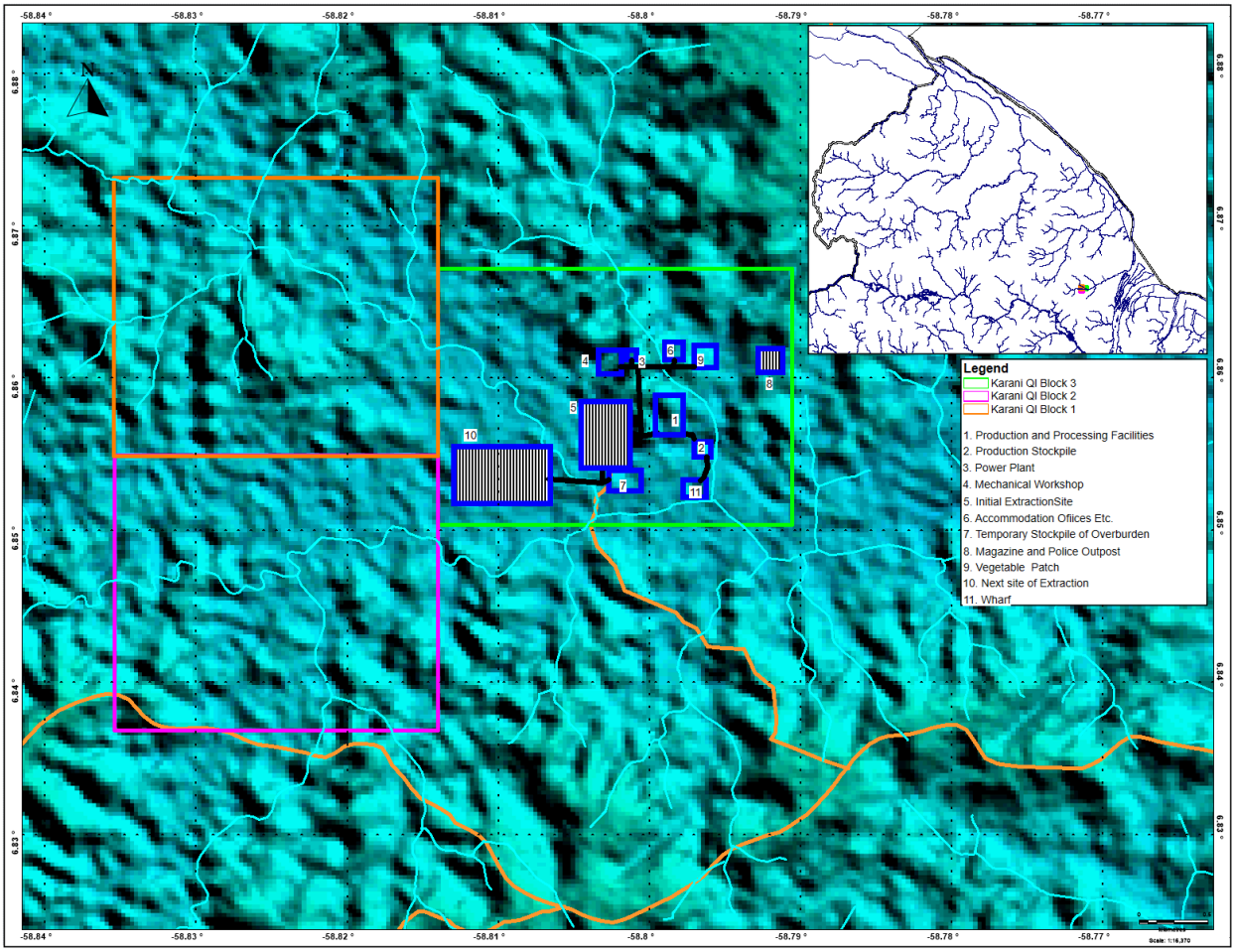


Figure 14. Mine plan Schematics and Layout

KERITI QUARRY PROJECT						
ITEM	**PERCENTAGE**	Year 1	Year 2	Year 3	Year 4	Year 5
1ST Grade Crusher Run	10%	33000	33330	33663	34000	34340
2nd Grade Crusher Run	2%	6600	6666	6733	6800	6868
7/8" Aggregate	2%	6600	6666	6733	6800	6868
3/4" Aggregate	45%	148500	149985	151485	153000	154530
5/8" Aggregate	2%	6600	6666	6733	6800	6868
1/2" Aggregate	15%	49500	49995	50495	51000	51510
Sifting	4%	13200	13332	13465	13600	13736
Underlayer	10%	33000	33330	33663	34000	34340
Sand	5%	16500	16665	16832	17000	17170
Boulders	5%	16500	16665	16832	17000	17170
Total	**100%**	**330000**	**333300**	**336633**	**339999**	**343399**

Table 2. Predicted Production for Keriti Quarry Proposed Mine 2022-2026

9.1 Geotechnical

The pit design process consists of designing ramp access to the bottom of the pit using the geotechnical recommendations guiding the bench geometry. The ramp access will slope at 30 degrees. There are final pits for each quarry pit. All pits in a sector were considered a single pit that will be mined bench by bench.

The ramp for each pit was located on the lowest wall to minimize the hauling distance and reduce activities along the high wall. Mining the stone was designed with the same geotechnical parameters as granite. However, since this type of material is found near the surface, the mining will be done by a dozer that will pile the material and then by the loading equipment that will load the material. This technique will respect the overall slope angle of 50 degrees.

9.2 Pit Optimization

Pit optimization is based on a USD 30/ton aggregate price to create a series of quarry blocks for analysis. Quarry design is based on a conventional surface mine using 76mm blast holes, 4.2m^3 front end loaders, and 1.5m^3 excavators for stone and waste loading; and haulage by a fleet of 43.5-ton capacity trucks.

The ultimate pit design incorporates pit slope geometries (bench face angles, inter ramp angles, and berm widths) for various rock types and pit sectors, includes haulage ramps, and takes into account minimum mining width based on the mining equipment selected.

9.3 Open Pit Mineral Reserve Estimate and Production Schedule

The total mineral reserve within the designed pits is 1.8 million, and Phase 1 production of 1.6 million tons of stone. The area of the proposed pits is 43.11 and 92.83 acres, respectively. Mining waste volume is 14,627,500 m^3 with stripping ratios 6.3 to 1 and 9.3 to 1. The annual production for the first few years during the consolidation of operations will be 330,000 tons of aggregate and boulders, and other sea defense-related materials. It will increase incrementally by 10%, depending on supply and demand.

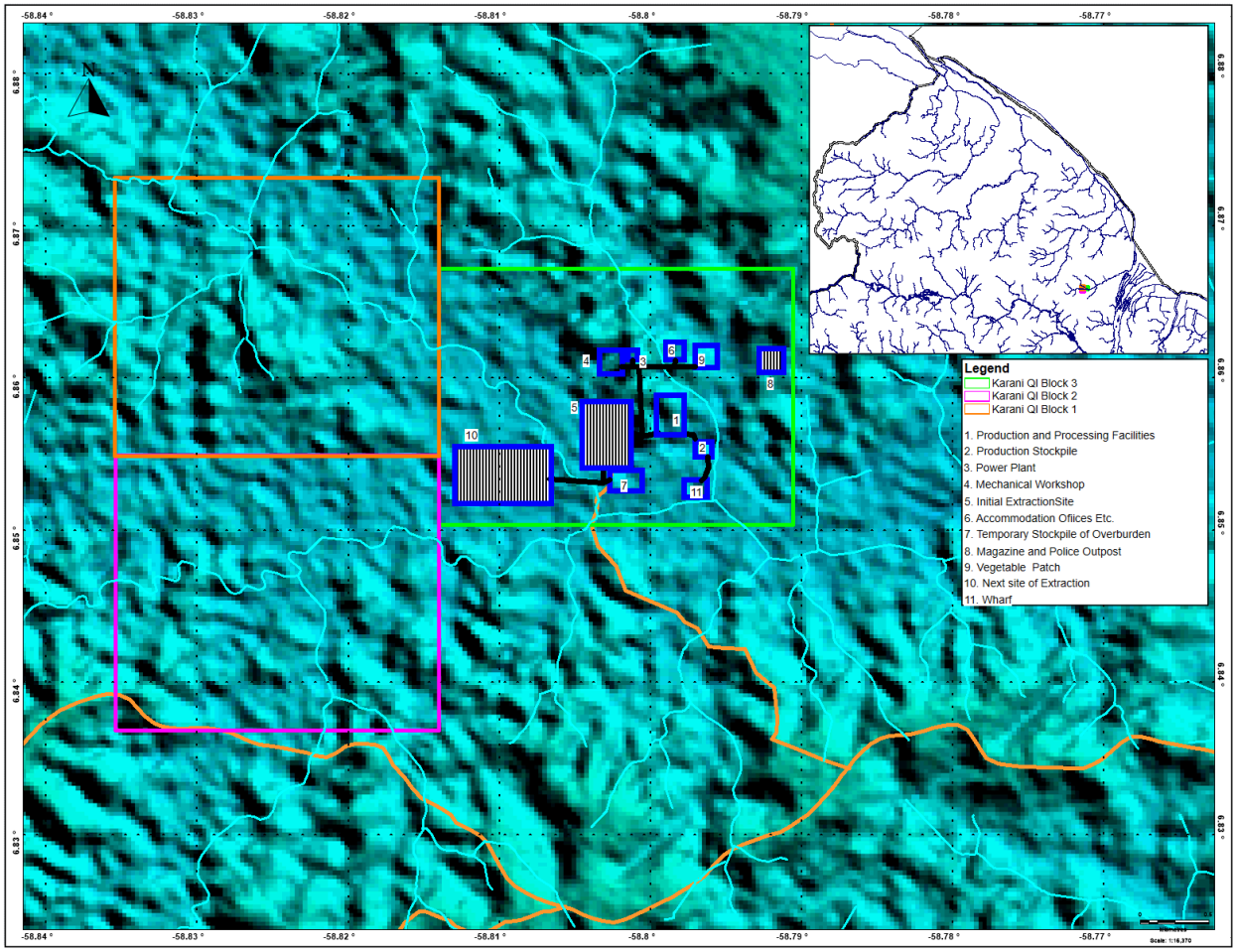


Figure 15. Conceptual Mine Pit Design

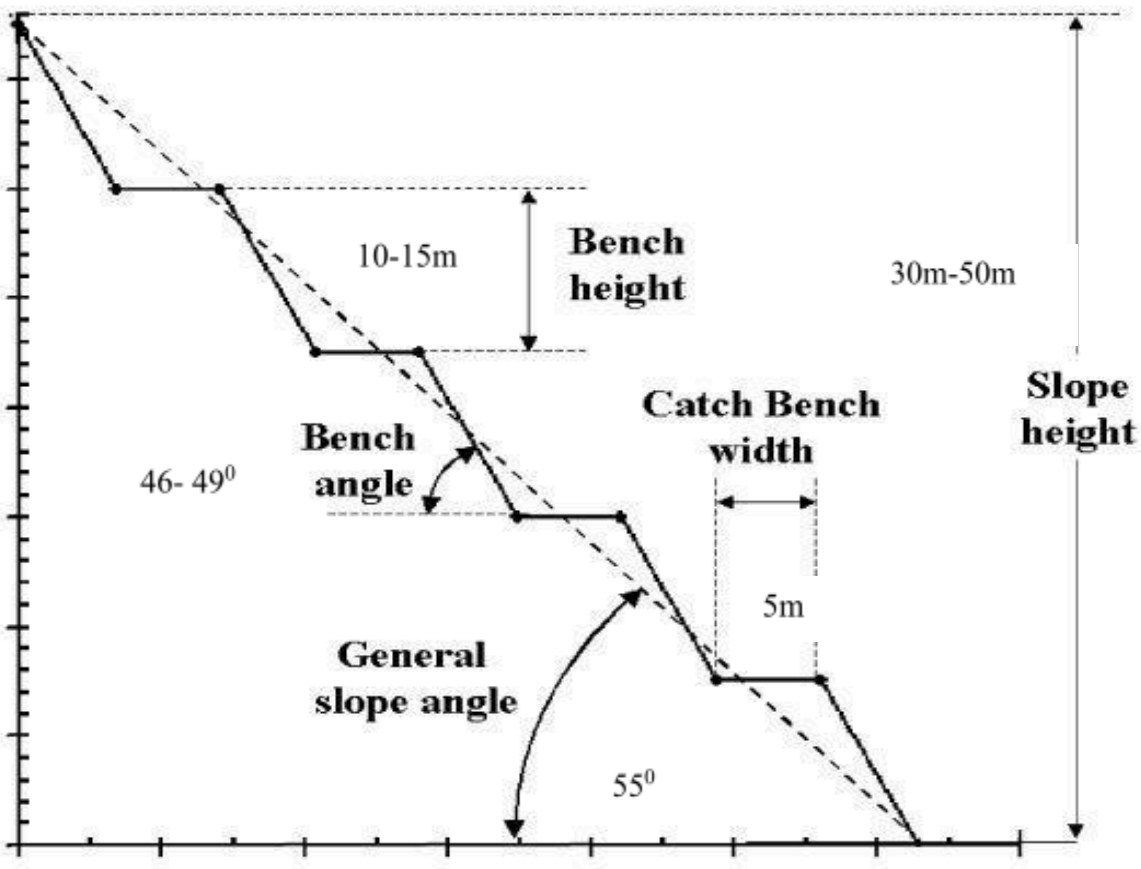


Figure 16. Cross-section view of proposed Pit wall dimensions

9.4 Overburden and Waste Stock Pit

A General Site has been selected behind the pit. Nine acres in the low-lying area west of the pit have been selected as the dumpsite. Due to the distance, one waste dump will allow for reduced cycle times. Dump with ramp were held to the same design criterion:

Waste Dump Designs

• 22-degree overall slope angles

• 3 m lift offsets.

• 3 m lift heights.

• Maximum height of 50-80m (from high elevation to valley bottom).

• Location of dumps away from villages, settlements, and rivers.

Dumps in a valley will have an overall slope angle of 37 degrees since the material will be dumped from a higher elevation than 3 m. Overall stripping ratio SRo (m3/tonne) - is the ratio of the volume of overburden (Vob) within the limits of the pit to the total tonnage of ore (TT) for

the entire ore body. A cross-section can be used to establish the relationship. Therefore, the Stripping ratio is 0.8 to 1, and it is within typical parameters for opening pit mining.

$$SRo = Vob / TT$$

Overburden	Depth m	Area m^2	Volume m^3	Tonnage t	Overall Stripping Ratio Vob / Tt
Pit 1	30	174,500	5,235,000	830,157	6.3
Pit 2	25	375,700	9,392,500	1,006,075	9.3

Table 3. Stripping ratio of Overburden to be dumped

Stripping and removal of overburden

Due to the geological conditions present at the proposed mine site, there is a fairly uniform layer of saprolite overburden covering the fresh rock in all of the higher elevations; this overburden is generally between 30m thick and needs to be removed by stripping to allow access to and extraction of the fresh rock. The Cat. D8 bulldozers, excavators, and trucks will spend 100% of their time for the first month to strip the overburden and establish the working faces. After which, the bulldozer will carry on much of this work by itself, with the excavators and trucks using an expected 20% of their time when necessary to help remove the overburden. Dumping of overburden will take place outside the stripping limits into valleys and other low areas; adequate dumping room is available

9.5 Stockpile Requirements

15,000 Ton stockpile will be placed at the mobile crusher to accommodate smooth operations. The Trucks will dump the quarry material to the stockpile site, where a dozer will feed directly into the mobile crusher. A jackhammer will be utilized to fragment oversize to the necessary screen size to allow easy processing.

9.6 Mine Manpower requirement

In the mining operations, 30 personnel are handling current production with an additional 4 in supporting services. The total number of staff is expected to increase by 13% over the next five years. The average efficiency of the system is expected to be 92%.

Activity	Shift (hours)	No. of Shifts per day
Stripping	10	1
Loading & Hauling	10	2
Drilling & Blasting	10	1
Crushing	10	2

Table 4. Shift Schedule Hours per activity

Year	Output	Efficiency
2022	330000	90%
2023	333300	91%
2024	336633	92%
2025	339999	93%
2026	343399	94%

Table 5. Yearly Production and Efficiency

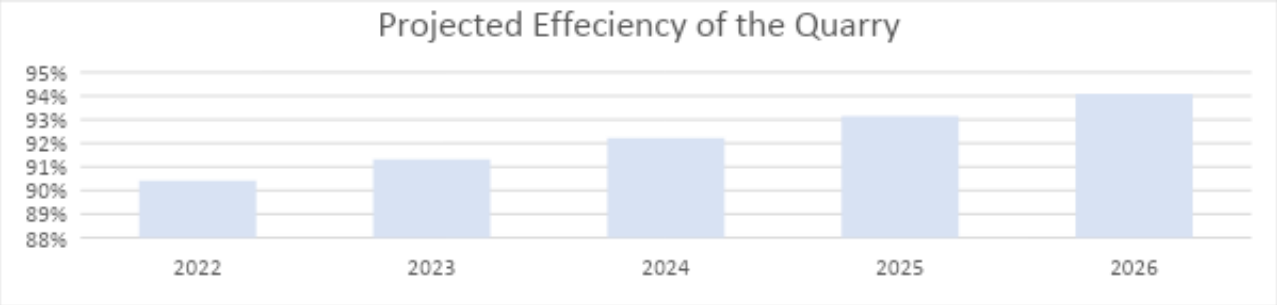


Figure 17. The efficiency of the Keriti Quarry Project

The staffing needs to be increased after every year as production increased; it will see an additional four persons being hired to meet the requirements over the years. However, supporting staff would be needed for the haulage road construction, accommodation, mine pit, and power plant housing.

Productivity	
Ton Per day	1000
Total Manhours per day	2500
Productivity = ton per day / Manhours per day	
Productivity =	0.4

No. Personel for 2022	
Daily Production	942.8571
Total Manhours per day	2357.143
Total Shift Hours	72
Total number of Personnel Required = Total Manhours per day / total shift hours per day	
No of Personnel	**32.7381**
	33

No. Personel for 2023	
Daily Production	952.2857
Total Shift Hours	2380.714
Total Shift Hours	72
Total number of Personnel Required = Total Manhours per day/total shift hours per day	
No of Personnel	**33.06548**
No of Personnel	**33**

No. Personel for 2024	
Daily Production	961.8086
Total Shift Hours	2404.521
Total Shift Hours	72
Total number of Personnel Required = Total Manhours per day/total shift hours per day	
No of Personnel	**33.39613**
No of Personnel	**33**

No. Personel for 2025	
Daily Production	971.4267
Total Shift Hours	2428.567
Total Shift Hours	72
Total number of Personnel Required = Total Manhours per day/total shift hours per day	
No of Personnel	**33.73009**
No of Personnel	**34**

No. Personel for 2026	
Daily Production	981.1409
Total Shift Hours	2452.852
Total Shift Hours	72
Total number of Personnel Required = Total Manhours per day/total shift hours per day	
No of Personnel	**34.06739**
No of Personnel	**34**

9.7 Machine Utilization

Trucks (CAT 745)

Fleets Size	-	3
Mechanical Avail. (%)	-	75
Operating Efficiency (%)	-	75
Overall Utilization (%)	-	32.05
Operating System	-	(2*10*6)
Number of Operating Days	-	312
Av. Truck Production (tons)	-	30
Cycle time (Mins.)	-	60
Av. Total Production (Tons)	-	315,900
Av. Production losses (2.5%) (tons)	-	6,318
Av. Annual Crude rock supply (tons)	-	309,582
Av. Number of Operating hours	-	6,240

345 Hydraulic Excavators (Caterpillar)

Fleet Size	-	4
Mechanical Avail . (%)	-	80
Operating Efficiency (%)	-	50

Overall Utilisation (%)	-	40
Operating System (%)	-	(2*10*6)
Number of Operating Days	-	350
Number of Operating hours	-	10,240

988 Wheeled Loader (Caterpillar)

Fleet Size	-	2
Mechanical Avail . (%)	-	80
Operating Efficiency (%)	-	50
Overall Utilisation (%)	-	40
Operating System (%)	-	(2*10*6)
Number of Operating Days	-	350
Number of Operating hours	-	5,120

Ingersol Rand Drill (ECM 590)

Fleet Size	-	2
Mechanical Avail. (%)	-	80
Operating Efficiency (%)	-	50
Overall Utilisation (%)	-	40
Operating System	-	(1*10*6)
Number of Operating Days	-	240
Number of Operating hours	-	1,920

Generator (650KVA CAT)

Fleet Size	-	2
Mechanical Avail. (%)	-	75
Operating Efficiency (%)	-	80
Overall Utilisation (%)	-	60
Operating System	-	(2*24*6)
Number of Operating Days	-	350

Av. Number of Operating hours - 11,520

9.8 Life of Mine

Based on the projected Quarry production on the total amount of ore to be processed will be on average 857t/day, whereas, max capacity of the current system is 1000t/day with a 330-day working schedule that caters for 35 days of downtime, maintenance, and miscellaneous activities. The life of the Mine is expected to be five years; however, given an average efficiency of 92%, and it will take longer for this resource to be completely exhausted.

Total estimate resource = 1,683,331 tons of stone for five years

Production for the Five years = 5-year production x efficiency

= 1,683,331 tons' x 92%

= 1,548,664 **tons**

Yearly Production = 1,548,664 tons / 5 year

= 309,732 tons per year

Remaining tonnage = 134,666 tons

Therefore, to find the additional life of this mining operation =

Remaining tonnage/Yearly Production

= 134,66 tons/ 309,732 tons per year

= 0.44 years

The Life of this Mine Operation is expected to last for 5.44 years, given an average efficiency of 92%.

10.0 Proposed Drilling and Blasting

The drilling and blasting plan cater for efficient rock excavation. A tried, tested, and proven delay design will be implemented to achieve the best fragmentation, heave, and muck pile profile. The blast patterns to be used will be multi-row staggered rectangular arrangements.

To meet production goals, four holes are needed to be drilled per day. One drill is needed to meet this target. ECM590's will be used because of their relatively low cost and their ability to drill holes in a single pass, reducing drilling times. Penetration rates for blast hole drills were assumed to be 132 feet per hour and a set-up time between holes of 4 minutes. The average depth of the holes is 34.4 feet. The drilling time for each hole, including set up time, is 20 min per hole. With the 50-minute hour operating time, it is estimated that each drill will complete an average of 48 holes per 12-hour shift. Table 6 shows the drill that will be used on site.

Group	Equipment	Manufacturer	Cost (USD)
Drill	*ECM590*	*Ingersol Rand*	$ 400,000

Table 6. Drill Fleet

10.1 Blasting Methods

Explosives are used to fracture the high-quality Gabbro to enable the extraction of the resource by earth-moving equipment. To achieve this, holes are drilled in a pre-determined pattern giving attention to their angle, depth, and spacing. These holes are then filled with an explosive, and the charge is initiated with the aid of primers and detonators. The detonation of each hole is delayed in a pre-designed sequence to ensure that each hole is fired individually in close succession. This delayed firing technique improves the efficiency of the blast and also reduces its environmental impacts.

The design of a blast depends on its location, geological structures in that area, the volume of resource in the target area, end product requirements, and any limiting factors in relation to potentially sensitive locations (including residences and infrastructure). Blast design is therefore completed on a blast-by-blast basis, ensuring that all these factors are considered to

achieve blast levels within acceptable limits.

10.2 Blast Layout Calculations

Due to the expected annual rainfall and temperature range of the Keriti Quarry Quarry area, it was decided that an explosive with reasonable resistance to both water and high-temperature conditions should be selected for production blasting. Based on these requirements, MAGNAFRAC 2.5" X 16' was selected. The specific gravity of the explosive was assumed to be 1.2 g/cc. The rock mass at the Quarry site was given at 2.5 ton/m^3. A blast hole diameter of 3 inches was selected. It should be noted that it is within the range of hole sizes that the drill rig, an ECM590 is capable of drilling. The bench height was set at 32.8 feet to best accommodate the equipment fleet.

Blast Dimensions	
Burden	5.3 ft.
Spacing	8.8 ft.
Subdrill	1.6 ft.
Hole Depth	34.3 ft.
Stemming Length	4 ft.
Explosive Column length	30.4 ft.

Table 7. Calculated Blasting Parameters based on Geotechnical Properties of the Granite

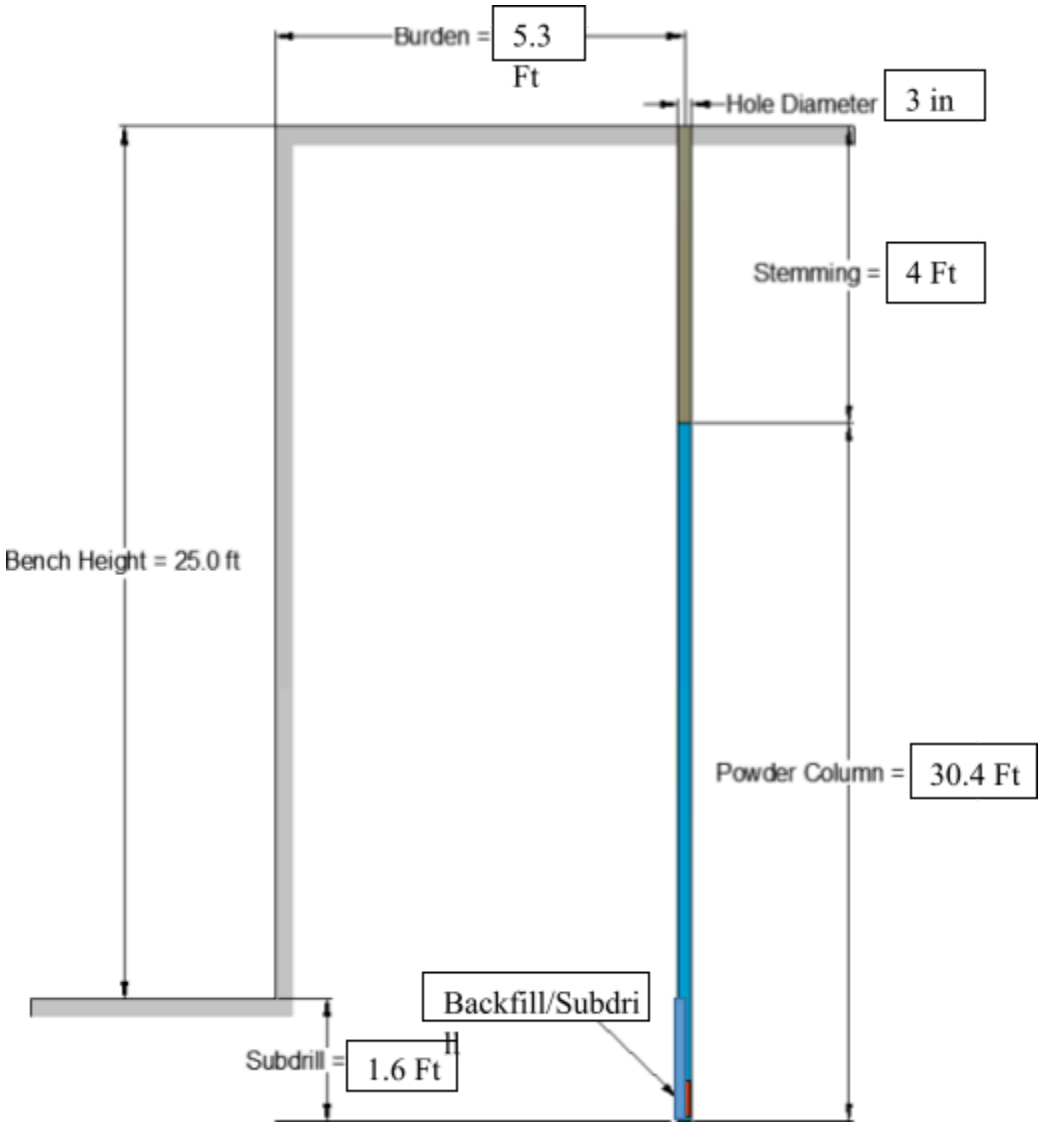


Figure 18. Blasthole Layout

The blast holes will be drilled on a rectangular pattern, with dimensions as shown in Tables 8. Blasts will be based on a per hole basis; that is to say, the amount of material broken per blast hole was calculated and used to determine the number of holes required to meet production each year. A blast with the aforementioned dimensions can be expected to liberate 56.7 Yd^3 (108.4 tons) of material per blast hole. Table 8 shows the number of holes required per day to meet the production goals. It should be noted that this table shows the minimum required holes per year, and in practice, it is likely that patterns will not be blasted daily.

Year	Time	Total Fresh Ore & Rock to be Blasted (Tons)	The volume of Rock (m^3)	No. Of Blast Holes	Total Explosives (kg/Magnafrac)	Total Drilling & Blasting Cost
2022	Year 1	330,000.00	113,129.93	2,786	99,201	684,189
2023	Year 2	333,300.00	114,261.23	2,814	100,193	691,031
2024	Year 3	336,633.00	115,403.84	2,842	101,195	697,941
2025	Year 4	339,999.33	116,557.88	2,871	102,207	704,921
2026	Year 5	343,399.32	117,723.46	2,900	103,229	711,970
Total		**1,683,331**	**580,459.19**	**14,214**	**506,027**	**3,490,053**

Table 8. Yearly Blast Production Requirements for Gabbro

The explosives column weight required per hole will be 78.3 lbs., which equates to a powder factor of 1.38 lbs./yd^3. Each hole will be initiated with a combination of Excel Handi Dets and Electric detonators. The time delay between holes will be 8ms to ensure good fragmentation, and a time delay between rows will be 11.4ms. As a further precaution, no two holes will be allowed to detonate within 8ms of each other to reduce the impact vibration.

10.3 Fragmentation

The Kuz-Ram Model was used to predict the expected fragmentation for production blasting within the open pit mine (Calculations shown in Appendix 1). Figure 19 shows the expected blast fragmentation for the quarry sites. It should be noted that this calculated fragmentation curve is similar enough to existing fragmentation curves to give reasonable confidence in the design.

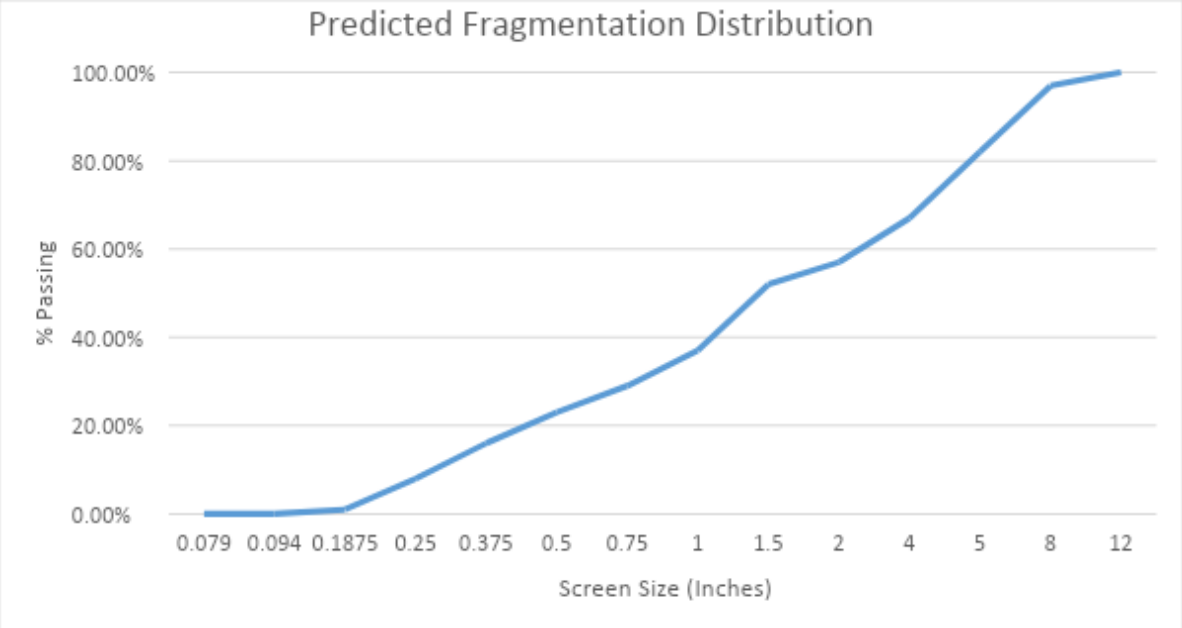


Figure 19. Grading Curve of the Granite

10.4 Blast Safety Considerations

It was important to consider safety factors in the production blast design for the Keriti Quarry Project. Only trained members of the powder crew will be allowed on blast patterns that have been or are being loaded. Whenever possible, blasting will occur before the operating shift has begun. This stipulation will ensure not only that a minimum amount of personnel is exposed to blasting hazards but also that production will not be interrupted by blasting.

10.5 Blasting Personnel Requirements

It was necessary to calculate the personnel requirements for the blasting crew in order to arrive at an accurate blasting cost for the operation. For these calculations, it was assumed that the blasting crew would spend 6 minutes on each hole. This time takes into account the placing of MAGNAFRAC, HANDI-DET/EXCEL HTD, all in one combination of electric detonators at 10ms and 20ms delay connectors with Cordtex of suitable lengths, placement of stemming, maneuver time between holes, and the time taken to tie in the pattern. An extra hour was allowed on top of the time required to load holes to account for the time needed to shoot the blast and any other unforeseen issues.

It was assumed that four blasters would be required to load the blast. All the blasters will place the

explosives, detonators, and DET cords into the holes, and one will place stemming into the holes using a skid steer loader. Once all the holes are loaded, all three blasters will tie in the pattern and retreat to a safe distance for detonation.

11.0 Regulatory Requirements

11.1 General Regulations

The maintenance and operation of explosives magazines and the use of explosives are subjected to The Explosives Act: Chapter 16:06 and The Blasting Operations Act Chapter 65:03 of the Laws of Guyana. Construction, storage, and management of the explosive magazine and use of

explosives will be in accordance with the relevant sections of 'The explosives Act: Cap.16:06.'

and 'The Blasting Operations Act: Cap. 65:03.'

11.2 Magazine Licenses

When a magazine is constructed onsite, general rules for magazine construction and upkeep under Section 6 of The Explosives Act Cap. 16:06 will be observed and implemented. A proposal with the construction details and location will be submitted for approval prior to construction to ensure that a license is granted.

11.3 Storage

Explosives will be stored in an approved, licensed, and properly constructed magazine under suitable conditions to:

- Comply with statutory regulations;
- Minimize the risk of accidental spills and explosions;
- Minimize deterioration that may adversely affect safety or performance;
- Provide separation of incompatible explosives;
- Prevent unauthorized access and theft;
- Provide safety distances from 'protective works';
- Maximize shelf-life; and
- Enable ready access to products when required.

11.4 Location of Magazine

The explosives magazine will be located approximately 1000 feet from the plant and dwellings structures. The site will be cleared so that there is no danger from bush fires, and the local fire.Authorities at Bartica will be informed of the location of the magazine. The detonator magazine

will be located at the legally prescribed distance (approx. 100 ft.) from the explosive's magazine in accordance with The Explosives Act Cap. 16:06.

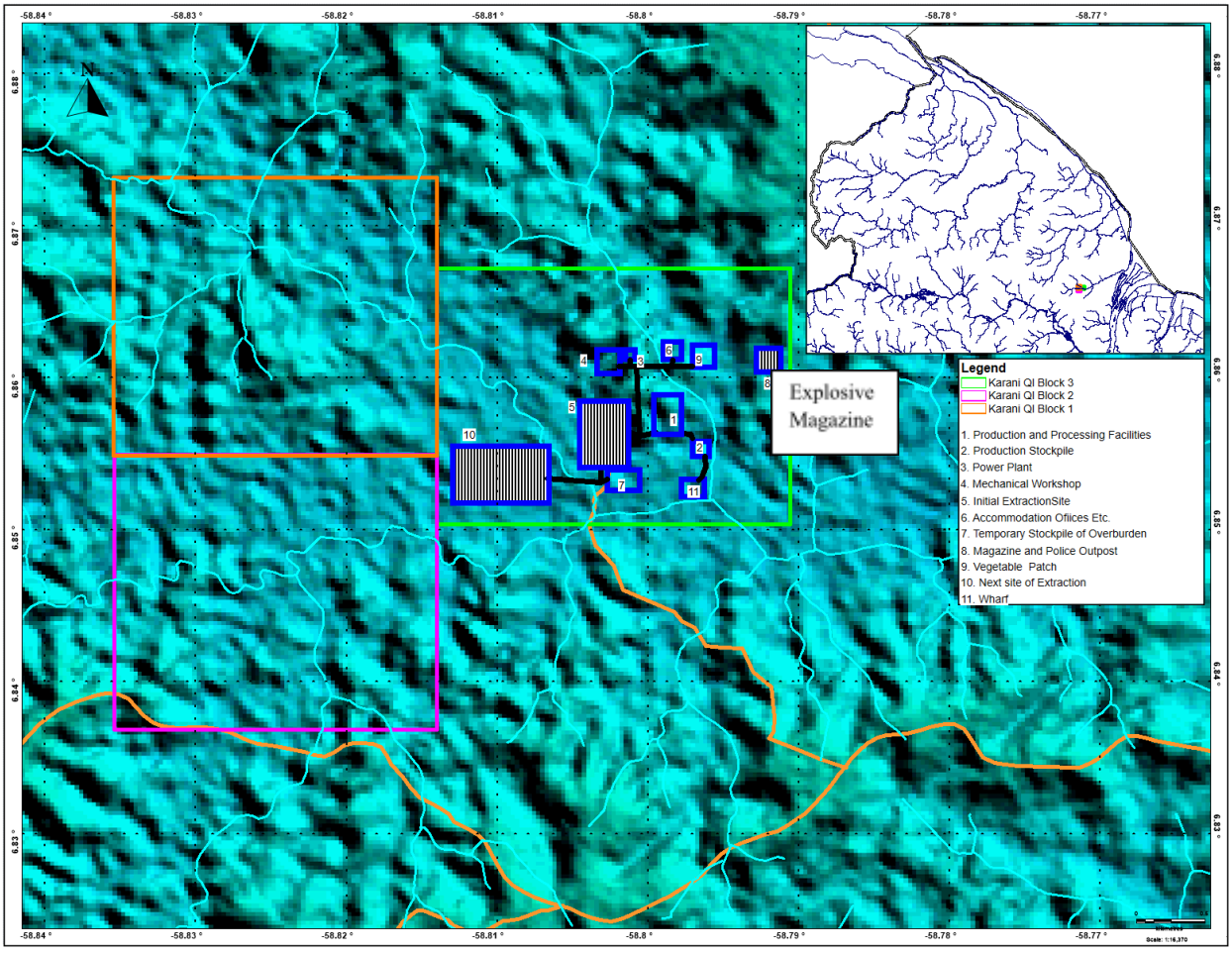


Figure 20. Location of the Explosive Magazine

11.5 Transport of Explosive

Explosives will be stored at the National Magazine, Makouria, in accordance with Section 8 of The Explosives Act Cap. 16:06. They will then be transported under GPF/Army escort to the proposed wharf on the Essequibo river, then to the Karani Quarry Quarry Project Area.

12.0 Blast Area Safety

The shot firer responsible for firing a blast will ensure that all people are aware of the intended firing time and clear the area before firing. Suitable barricades, cautionary signs, and sirens will serve as direct communication to prevent personnel from entering a blast area at firing time.

12.1 Misfires

The muck pile will be inspected for signs of misfired detonators, detonating cord, or explosives. The explosive manufacture data sheet will be referred to for dealing with misfires. Misfires will be reported to the Site Manager and recorded in the Mine record Book.

12.2 Blast Pattern Design

A Mining Engineer will design each blast. A blaster with a certificate of competency granted under Section 4 of The Blasting Operations Act Cap. 65:03 by the Commissioner, Guyana Geology and Mines Commission will perform blasting at the Mine Site. As standard procedure, blasters will follow the practice of making pre-blast or loading charts. This will be used to calculate the amounts and types of explosives based on the number, diameter, depth of holes, and stemming required -

Blast designs are based on empirical information from industry standards and applications and from experience in similar geological conditions. Information provided for the Karani Quarry Project are as follows:

- Geology- granite density 2.5
- Overburden- Saprolite, Laterite, and clays
- Bench Height- 32.8 Feet
- Groundwater-not a major issue, but some water will be present
- Use of MAGNAFRAC 2.5” x 16” Package Explosive
- 3 inch (76 mm) hole diameter

Based on this information, a one pattern blast design was completed for the hard rock ore horizon, as shown in the table below:

Material	Bench Height (ft.)	Hole Diameter (in.)	Burden (ft.)	Spacing (ft.)	Subdrill (ft.)	Stemming (ft.)	Explosive Density	Powder factor (lbs./yd^3)
Ore/Overburden	32.8	3	5.3	8.8	1.6	4	1.2	1.38

Table 9. Blasting Parameters Calculated for gabbro

12.3 Blast Vibration

Another important consideration for surface blasting is the vibration levels. A primary concern for the Karani Quarry Project is the proximity of blasting to the process plant and Dwellings. It was assumed that the closest any blast will be to the plant structures and dwellings is 500 meters. Based on the particle velocity calculations (Appendix 1), the current blast design is sufficient to prevent damages to infrastructure, as shown in table 10.

Vibration Analysis	
Damage	***USBM Value (in/sec)***
Lowest Cracking Value	0.51
Crack extension in plaster	0.72
Crack extension in wallboard	0.79
Crack in CMU	6.37
Keriti Quarry project, 500 meters from structures	0.1132

Table 10. Vibration Analysis of Granite Rock

12.3.1 General Methods to Mitigate Blast Vibration

Reduction in maximum instantaneous charge (effective charge mass per delay) by:

- Reduction in the size of blasts.
- Reduction in blast hole diameter.
- Use of a lower density bulk explosive product.
- Deck loading- Separation of charges over the length of the drill hole. Decks may be fired on different delays using electronic detonators.

- Timing design- Choice of appropriate delays to allow gaps in the initiation sequence. Depending on the size of the blast and the required vibration limit, it may not be possible to achieve the required MIC (Maximum Instantaneous Charge) with non-electric detonators, as the restricted delay range of conventional detonators prevents the use of gaps in the initiation sequence created by either longer delays or decreased rows.

12.4 Airblast

Airblast frequencies are much lower than vibration frequencies, so it is appropriate to select a MIC based on the number of holes firing during 200ms, as this time represents the half period of a 5Hz waveform. The Western Australasian Environmental (noise) Regulations (1977) Regulation 11 specifies that no airblast levels resulting from blasting between 0700 and 1800 on any day may exceed 120dBL at sensitive sites or 125dBL at any location other than a sensitive site; however, these limits do not apply when received at premises where the blaster believes on reasonable grounds that no person is present at the time of the blast.

In the case of the Karani Quarry Project, using 250m as the distance from sensitive sites, in order to comply with the 115dBL limit for 9 out of 10 consecutive blasts, this would require a maximum charge weight per 200ms delay of approximately 783lbs, or ten holes. This would be very challenging to achieve using standard nonelectric delays. Airblast is directional, however, so it is possible to greatly reduce the levels detected at monitoring points by altering the firing direction. Whenever possible, blasts should be fired such that the movement of the blasted rocks will be away from the sensitive sites. This will greatly reduce airblast, provided the blast is fired downwind, and atmospheric conditions are favorable.

12.5 Flyrock

Flyrock is defined as rock particles that are projected beyond the general area of the broken rock mass within the blast zone. Maximum Flyrock distance is 540m. There are three common types of Flyrock. These are:

- The face of the blast, in which Flyrock is generated through a ‘face burst.’
- The bench top, through a phenomenon known as ‘cratering’; and
- The stemming zone, where Flyrock is generated through ‘rifling.’

12.6 Loading

The blasting crew lead by the Blaster-in-Charge will have the necessary tools and equipment to

safely and efficiently load the explosives. Among the necessary tools and equipment required:

1. Blasting Galvanometer or Blaster`s Multi-meter
2. Non-metallic measuring tapes equipped with lead or non- sparking weights
3. lowering ropes
4. Retrieving hooks
5. Tamping poles
6. Powder knives
7. Mirrors
8. Friction tape
9. Connecting wire
10. Lead line
11. A power source (blasting machine, sequential blaster, etc.)

12.7 Detonator Safety

The Blaster-in-Charge must be knowledgeable of all safety precautions regarding the detonator and the associated initiating system components before loading begins. All initiation systems must be used in accordance with the methods prescribed by the manufacturer.

12.8 Electrical Detonator Safety

Electric detonators shall be checked with a proper test instrument before primer makeup. To ensure that the detonators have not been damaged during loading, they should be rechecked before stemming. Electric detonators are designed to be fired by a pulse of electrical energy and are susceptible to accidental firing by extraneous electricity, e.g., electrical storms, radio frequency energy, etc.

12.9 Non-electric Detonator Safety

Nonelectric initiation systems must be used in accordance with methods prescribed by the manufacturer. The Blaster-in-Charge is responsible for all aspects of safety and use of nonelectric firing systems and must be knowledgeable with all system components and their compatibility with explosives and other initiation systems.

12.10 Misfires

Specific recommendations concerning misfire handling procedures cannot be universal since each misfire must be evaluated on an individual basis. The safest and surest way of handling any

type of misfire is to be able to reconnect all unfired charges and then fire them. Under no circumstances should misfire explosives be reuse

13.0 Blasting Criteria

Karani Quarry Project undertakes blast monitoring to verify that the limits for airblast overpressure levels and ground vibration peak particle velocity are not exceeded at any point within one meter of any affected residential boundary or another noise-sensitive area. The Karani Quarry Project shall ensure that blasting on site does not exceed the criteria at any residence on privately-owned land.

The air blast overpressure level from blasting operations must not exceed:

- 115 decibel (dB) (Lin Peak) for more than five percent of the total number of blasts over each reporting period
- 120 dB (Lin Peak) at any time.

The ground vibration peak particle velocity from blasting operations must not exceed:

- 0.197 inch per second (in./s) for more than five percent of the total number of blasts over each reporting period
- 0.394 in./s at any time
- at any point within one meter of any affected residential boundary or other noise-sensitive areas in the vicinity of the plan

14.0 Blast Management Controls

Karani Quarry Project is committed to implementing reasonable and feasible best practice blast impact mitigation measures at the Keriti Quarry Project.

In order to mitigate any potential blast impacts from the operation, a number of blast management controls will be implemented throughout the life of the operation. The relevant blast controls for the operation are detailed in the sections below and will be reviewed to confirm their applicability on an ongoing basis through the process outlined in **Section 12.0**.

14.1 Hours of Operation

Impacts to public amenity for sensitive receivers in the vicinity of the Karani Quarry project have been managed through the design of the operation, including the restrictions on the hours of operation for the facility. The operating hours for the Karani Quarry project are described in Table 11 below. The Karani Quarry Project will operate in accordance with the operating hours defined in Table 11.

Activity	**Operation Hours**
Extraction Operations	6 am to 6 pm Monday to Saturday
Loading and Dispatch	6 am to 6 pm Monday to Saturday
Construction and Maintenance activities	6 am to 6 pm Monday to Saturday
Blasting	9 am to 5 pm Monday to Saturday

Note: The Applicant may carry out maintenance activities after hours.

Table 11. Operating Hours

14.2 General Controls

Control measures that have been considered as a standard part of the operation of the Karani Quarry Project and incorporated include:

- All relevant mining personnel will be trained on the environmental obligations in relation to blasting controls.
- The surrounding landowners/miners will be notified prior to undertaking a blast.
- The date, location of blast holes, and quantity of explosives used each day will be documented.
- Blasts will be designed to comply with overpressure and vibration criteria.
- Monitoring will be undertaken at the nearest residence and/or other sensitive locations (as required) to verify compliance with the relevant criteria.
- The maximum number of holes to be detonated in a blast is 150.
- Sufficient distance will be maintained between the blast hole and the mine face.
- Appropriate delays will be used.
- All blasts will be monitored and recorded.
- Blast monitoring data will be used on an ongoing basis to further refine the blast design and management.
- Blast design and blast management procedures will be periodically reviewed to evaluate performance and identify corrective action if required.
- Blasting will be undertaken between 9.00 am, and 5.00 pm, Monday to Saturday inclusive, except under apparent temperature inversions conditions when blasting shall only occur between 11.00 am and 1.00 pm Monday to Saturday. No blasting is undertaken on Sundays or public holidays without the approval of the Guyana Police Force (GPF).
- Karani Quarry Project will undertake consultation with miners and farmers whose properties are adjacent to the development, with a view to determining the most appropriate blasting times for the development. The applicant shall, in accordance with the requirements of the GPF, give notice of proposed blasting times.
- Not blast more than twice a week unless an additional blast is required following a blast misfire.

- Design all blasts to minimize airblast overpressure and vibration using the NONEL system of equivalent.
- Design all blasts based on the results of monitored blasts and modeled predictions in **Table 10**. This will minimize airblast overpressure and vibration such that any one blast has less than a five percent probability of exceeding airblast overpressure and vibration goals as set by the Environment Protection Authority (EPA) for affected property.
- EPL noise limits of 115 dB/120 dB are likely to be exceeded.
- Undertake detailed designs for each blast in order to maximize the blast efficiency, minimize dust, fumes, ground vibration, and airblast, the potential for flyrock, and ensure compliance with site-specific blasting conditions.
- Karani Quarry undertakes a pre-blast meteorological assessment in order to confirm the applicability of blasting during the proposed blasting times. The pre-blast meteorological assessment will inform the likelihood of potential blast impacts as a result of forecasted adverse wind inversion weather conditions.
- Monitor blasts as mining progress utilizing the adaptive management techniques described in **Section 13**, so that blast prediction site laws can be further refined and future blast designs can be optimized based on more detailed site information. By adopting this approach, in conjunction with the adoption of improved blasting products and methods, as they are introduced, it is anticipated that blast emissions criteria can be met without imposing any significant constraints on blast designs throughout the operation of the Karani Quarry Project. The company will design all blasts to comply with the project-specific vibration and air blast criteria and to protect public and private infrastructure and property from any damage as a result of flyrock. Future updates of this plan will include any additional management requirements, taking into account the results of blast monitoring undertaken.
- The blasting site design will be regularly reviewed using site-specific blast monitoring data. This process will provide the Karani Quarry project with flexibility to design blasts to best meet production requirements while complying with relevant criteria for residential receivers.
- All blast configurations and delays used will be thoroughly checked by the Mine Manager before the blasts are detonated

15.0 Blast Monitoring

Karani Quarry will monitor blasts as mining progresses in accordance with the existing blast monitoring system so that blast performance and design can be further refined and future blast designs can be optimized based on more detailed site information.

Blast monitoring for airblast and vibration will continue to be undertaken at strategically identified locations to ensure compliance with the Guyana EPA Environmental Permit and the GPF Permit to transport, store and use explosives.

15.1 Blast Data

Data collected for each blast will include:

- measured vibration
- measured overpressure
- maximum instantaneous charge
- number of holes
- blast type
- meteorological conditions.

15.2 Blast Fume Monitoring

Fume monitoring and post-blasting investigation into fume events will be undertaken at the Karani Quarry project. Fume monitoring requirements include:

- visual assessment and analysis of each blasting event to determine whether excessive fume was generated as a result of the blast. All blasts undertaken at the Karani Quarry Project will be video recorded to provide a record of the blast.
- In the event that any blast at the Karani Quarry Project leads to the development of excessive fume, an analysis of the blast will be undertaken to determine the cause of the blast fume development and whether the blast fume traveled off-site.
- Analysis of meteorological conditions to determine the likely, if any, the offsite impact of NOx fume events post-blasting.

15.3 Standards Relevant to Blast Monitoring/ Management

Karani Quarry will undertake blast monitoring at the Quarry project area in accordance with the policies, principles, regulations, and guidelines contained within:

- The Environmental Permit, Guyana EPA
- Guyana Geology and Mines Commission Guidelines; and
- The Permit to transport, store and use explosives.

16.0 Description of Mining Method

Open-pit mining method will be utilized, especially the stripping by dead-end approach. Stripping by dead-end approaches is applicable for deep deposits. Quarrying will be done by the bench by the bench. Blasting will be done according to the requirement of stockpile needed, and the necessary fragmentation will be executed to fulfill the needs of the ROM operations. Blasting is being done in a sequential manner beginning at the south end of the rock mass and progressing northward. The joining/fracturing of the rock is examined to determine suitable areas for drilling and the drill hole depth. A suitable drilling pattern will be determined and drilled. A suitable blast design is then established to determine the throw of the blast in order to get the maximum fragmentation and access to the blasted rock. The Full cycle of Operation will be drilling, blasting, loading, Hauling, stockpiling, and processing.

17.0 Loading and Haulage

Loading of blasted rock is being done by one (1) Excavators. Haulage of the blasted rock to the primary crusher, and the hauling of the ore material will also be stockpiled for the ROM operations. The operation will need approximately three trucks. **Pit 1 and 2:** The waste disposal is 800 meters northeast of the quarry, and the stockpile is approximately 1000 meters west of the quarry pit. Theoretical cycle times are both 13.9 minutes.

17.1 Loading

17.1.1 Quarry

Spot and Loading Time		
Tls = NP x Tcl Eq.3		
Where Np – number passes by the loading equipment, decimal number		
Ctw – truck capacity, t (tons): 42.5 tons		
Name	**Value**	**Unit**
NP	8.888888889	
Tcl	32	secs
ANSWER	**4.740740741**	**Minutes**

17.1.2 Overburden

Table showing excavator cycle times and fill factors.

Bucket Capacity		Average cycle time (secs)			
m^3	yd^3	E	M	M-H	H
3	4	18	23	28	32
4	5	20	25	29	33
5	6	21	26	30	34
5.5	7	21	26	30	34
6	8	22	27	31	35
8	10	23	28	32	36
9	12	24	29	32	37
11.5	15	24	30	33	38
15	20	27	32	35	40
19	25	29	34	37	42
35	45	30	36	40	45
Average fill factor		0.95 - 1.0	0.85 - 0.90	0.80 - 0.85	0.75 - 0.80

E – Easy digging; M- Medium digging; M-H – Medium-Hard digging; H – Hard digging.

Table 12. Loading time for excavators.

Spot and Loading Time		
Tls = NP x Tcl Eq.3		
Where Np – number passes by the loading equipment, decimal number		
Ctw – truck capacity, t (tons): 42.5 tons		
Name	**Value**	**Unit**
NP	16	
Tcl	18	secs
ANSWER	**4.707902353**	**Minutes**

17.2 Haulage

17.2.1 Truck Travel Time

Truck Travelling Time (Ore)		
TT = D/ (Vavg) Eq. 4		
TT = travel time, min:		
D = distance, km: 1.2 km		
Vavg. = average speed, km/hr: 20km per hour		
Name	**Value**	**Unit**
D	1.2	**km**
Vavg	20	km/h
ANSWER	0.060000	hours
	3.6	**Minutes**

Overburden

Truck Travelling Time (Overburden)		
TT = D/ (Vavg) Eq. 4		
TT = travel time, min:		
D = distance, km: 1 km		
Vavg. = average speed, km/hr: 20km per hour		
Name	**Value**	**Unit**
D	1.0	**km**
Vavg	20	km/h
ANSWER	0.050000	hours
	3	**Minutes**

17.2.2 Haulage Cycle Time

The theoretical cycle time for haulage units is influenced by the following:

- Load time
- Travel time to the dump area
- Dump or spread time
- Return time

The actual or corrected cycle time takes into consideration expected delays and waiting time. The following equation can be used to calculate the haulage cycle time. Where:

Quarry

Haulage Cycle Time (Ore)		
Tch = Tl + TTo +Tdp +TTr Eq. 5		
Tch = theoretical haulage cycle time, min		
Tl = equipment load time, min: 4.7 mins		
TTo = travel time to dump point, min: 3.6 mins		
Tdp = dump or spread time, min: 2 mins		
TTr = travel return time, min 3.6 mins		
Name	**Value**	**Unit**
Tl	4.7	mins
Tto	3.6	mins
Tdp	2	mins
TTr	3.6	mins
ANSWER	**13.94074074**	mins

Overburden

Haulage Cycle Time (Overburden)		
Tch = Tl + TTo +Tdp +TTr Eq. 5		
Tch = theoretical haulage cycle time, min		
Tl = equipment load time, min: 4.7 mins		
TTo = travel time to dump point, min : 3 mins		
Tdp = dump or spread time, min: 2 mins		
TTr = travel return time, min 3 mins		
Name	**Value**	**Unit**
Tl	4.7	mins
Tto	3	mins
Tdp	2	mins
TTr	3	mins
ANSWER	**12.74074074**	mins

17.2.3 Haulage Production

Quarry

Haulage Production (Ore)		
Ph = 60 x (Nh) x (Lh) x (E) / (Tch) Eq. 6		
Ph = haulage production, BCM/hr (BCY/hr)		
60 = minutes in 1 hr, min/hr		
Nh = number of haulage units, integer: 2		
Lh = haul load, BCM (BCY): 17m^3		
E = operating efficiency, decimal : 0.75		
Tch = corrected cycle time, min: 7.4 mins		
Name	**Value**	**Unit**
Time	60	mins
Nh	2	
Lh	17	m^3
E	0.75	credit
Tch	13.94074074	mins
ANSWER	**109.7502657**	m^3/h
	307	Tons/hr

Overburden

Haulage Cycle Production (Overburden)		
Ph = 60 x (Nh) x (Lh) x (E) / (Tch) Eq. 6		
Ph = haulage production, BCM/hr (BCY/hr)		
60 = minutes in 1 hr, min/hr		
Nh = number of haulage units, integer : 2		
Lh = haul load, BCM (BCY): 30.01m^3		
E = operating efficiency, decimal : 0.75		
Tch = corrected cycle time, min: 12.74 mins		
Name	**Value**	**Unit**
Time	60	mins/hr
Nh	2	
Lh	30.0128775	m^3
E	0.75	credit
Tch	12.74074074	mins

ANSWER	**212.0095707**	m^3/h
	594	Tons/hr

18.0 Proposed Mining Circuit

18.1 ROM

The ore will be stockpiled to be fed into the mobile crusher; the crusher has a 1000t/day limit; this will then be stockpiled for shipping by trucks. The quarry will ship crushed aggregate and boulders by use of one (1) tug and one (1) barge. The capacity of the company's barges are as follows:

No of Pontoons. (5000t)	**No. of Tug**
1	1

Table 13. Showing the Number of Barges that will be purchased

The Aggregates Produced are shipped from the proposed wharf site directly to Parika. It is estimated to make1 trip per day.

18.2 Future Expansion Capacity

The stockpile from the primary crushers would increase in processing when Quarry mining project when the supply and demand increase due to many constructions of hotels on the coast, the hydro-dam road, and the Linden-Lethem road.

19.0 Proposed Fuel Consumption

Item	**Gallon Consumption per annum**	**Price per Gallon**
Diesel	220,000	555
Gasoline	10,000	592
Lubricant oil	4,000	2590
Hydraulic oil	2,500	4,995
Grease	2,000	2201.5

Table 14. Projected Fuel Consumption Annually

		2022	2023	2024	2025	2026
Capacity Utilization	100%	50%	60%	70%	80%	90%
Diesel	154,660,000	77,330,000	92,796,000	108,262,000	123,728,000	139,194,000
Gasoline	7,400,000	3,700,000	4,440,000	5,180,000	5,920,000	6,660,000
Lubricant oil	13,320,000	6,660,000	7,992,000	9,324,000	10,656,000	11,988,000
Hydraulic oil	12,487,500	6,243,750	7,492,500	8,741,250	9,990,000	11,238,750
Grease	4,403,000	2,201,500	2,641,800	3,082,100	3,522,400	3,962,700
Total	**$ 192,270,500**	**$ 96,135,250.**	**$ 115,362,300.**	**$ 134,589,350.**	**$ 153,816,400.**	**$ 173,043,450.**

Table 15. Showing cost related to proposed fuel consumption

20.0 Proposed Equipment List

Karani Quarry will procure all the equipment necessary for the Quarry Project Operation. All the equipment is necessary to ensure smooth operations and produce at least 942 tons of aggregates daily. The proposed fleet of equipment comprises of the following:

EQUIPMENT LIST (Price New)	QUANTITY	Unit Cost (GYD)	TOTAL COST	TOTAL COST USD
Trucks (CAT 745)	3	$ 45,000,000.00	$ 135,000,000.00	$ 642,857.14
345 Hydraulic Excavators (Caterpillar)	4	$ 35,000,000.00	$ 140,000,000.00	$ 636,047.62
980B & 980C Wheel Loader (Caterpillar)	1	$ 15,000,000.00	$ 15,000,000.00	$ 71,428.57
Bulldozer (Caterpillar - D8)	1	$ 15,000,000.00	$ 15,000,000.00	$ 71,428.57
Mobile Crusher (100t/hr)	1	$ 90,000,000.00	$ 90,000,000.00	$ 428,571.43
Ingersol Rand Drill (ECM 590)	1	$ 80,000,000.00	$ 80,000,000.00	$ 380,952.38
Generator (650KVA.) Caterpillar	2	$ 5,000,000.00	$ 10,000,000.00	$ 47,619.05
Catepillar Hydraulic Hammer (130s)	1	$ 8,000,000.00	$ 8,000,000.00	$ 38,095.24
Cat Water Tanker	1	$ 8,000,000.00	$ 8,000,000.00	$ 38,095.24
Service Truck	1	$ 5,000,000.00	$ 5,000,000.00	$ 23,809.52
Compressor	1	$ 2,000,000.00	$ 2,000,000.00	$ 9,523.81
Fork Lift	1	$ 2,000,000.00	$ 2,000,000.00	$ 9,523.81
Tower Light	4	$ 500,000.00	$ 2,000,000.00	$ 9,523.81
Welding Plant	1	$ 2,500,000.00	$ 2,500,000.00	$ 11,904.76

Rubber Wheel Roller	1	$ 6,000,000.00	$ 6,000,000.00	$ 28,571.43
Steel Wheel Roller	1	$ 8,000,000.00	$ 8,000,000.00	$ 38,095.24
Skidder	1	$ 10,000,000.00	$ 10,000,000.00	$ 47,619.05
Tug Boat	1	$ 25,000,000.00	$ 25,000,000.00	$ 119,047.62
50000 m^3	1	$ 60,000,000.00	$ 60,000,000.00	$ 285,714.29
Toyota Land cruizer	1	$ 16,000,000.00	$ 16,000,000.00	$ 76,190.48
		Total	$ 639,500,000.00	$ 3,014,619.05

Table 16. List of Equipment

21.0 Proposed Staffing & Infrastructure

The company intends that the Quarry Project will be a model complex with facilities that are comparable with other regional and international Quarry operations. The topography is ideal with housing etc., overlooking the operation. The mine will have a full-time sanitation crew, and a medic will always be on-site with adequate medical supplies. Because of the threat of malaria in the area, the company will work closely with the Ministry of Health to maintain a malaria-free environment at the quarry and nearby communities. A small water treatment plant for potable water supply will be constructed near a suitable area within the quarry, and water will be supplied from the treatment plant to the various sectors of the quarry. The company will employ 30 personnel, broken down as follows:

21.1 Staffing

NO	STAFF	NO OF EMPLOYEES
1	Quarry Master/Manager	1
	Engineers	
2	Mining	1
3	Mechanical/ Mechanic	1
	Supervisors and others	
4	Compressor operator	1
5	Excavator Operator	2
6	Drill operator	1
7	Heavy duty operator	6
8	Heavy duty drivers	4
9	Store Keeper	1

10	Electrician	1
11	Laborers	5
	Services	
12	Blasting Services	4
	Auxillary Staff	
13	Cooks	1
14	Cleaners	1
15	Police officers	2
16	Security	1
17	Medic	1
Total		**36**

Table 17. Staff list

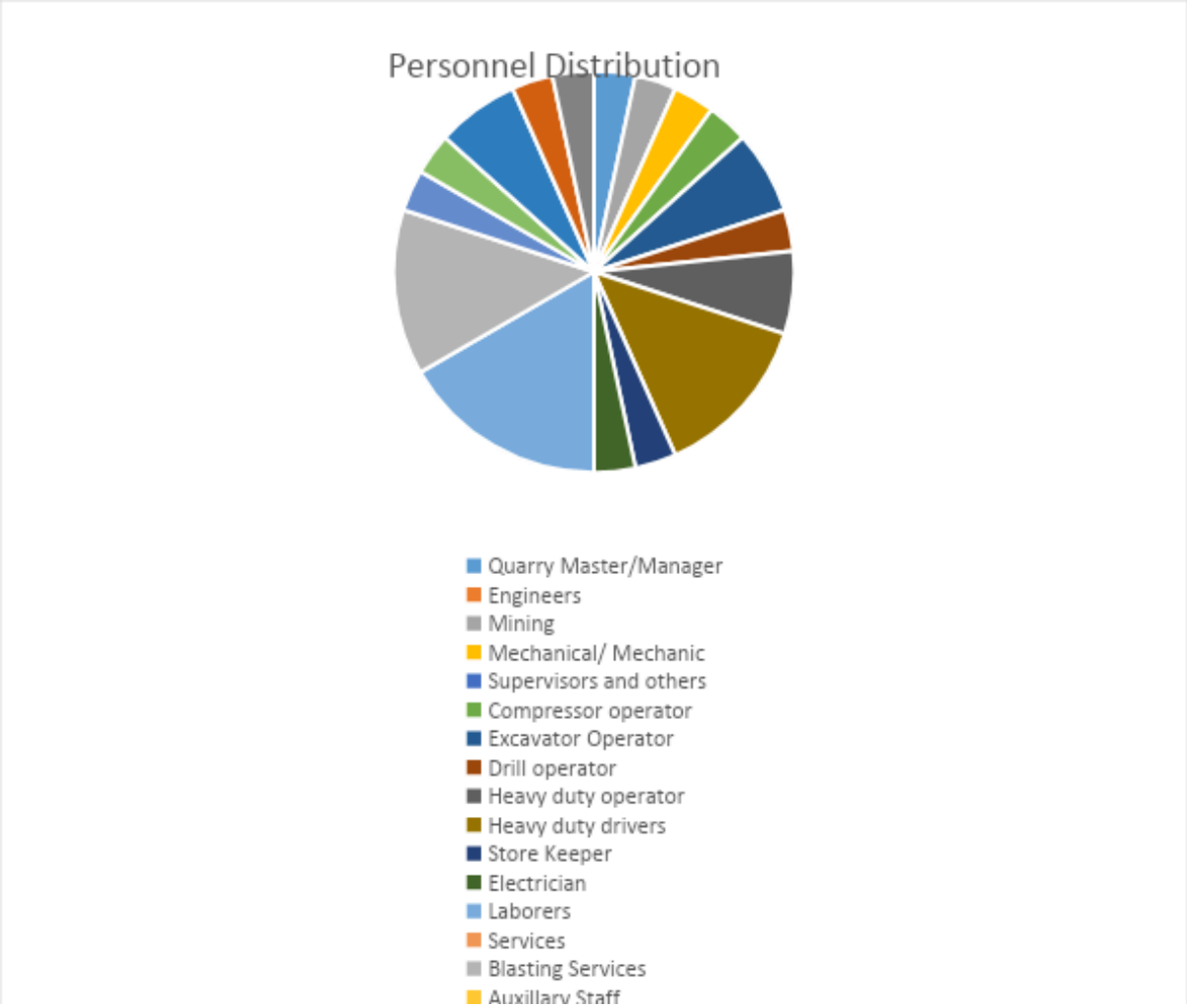


Figure 21. Personnel Distribution for Karani *Quarry Project*

This labor force is expected to be increased by 13% or about four persons for the next five years.

21.2 Proposed Infrastructure

Detail of Building and Civil Works		
Description	**Covered Area sq ft**	**Cost GUY$**
Offices/Prefabricated Containers	1000	$1,500,000.00
Workshop/Bond	1000	$1,500,000.00
Residential Setup /Prefabricated Containers	2,000	$3,500,000.00
Haul Road	6000	$3,500,000.00
Total	**10,000**	**$10,000,000.00**

Figure 22. Details for Infrastructure development

The operations and control building for mobile crushing unit

The entire mining circuit is integrated into one control system that monitors all of the feed rates, sizes, temperatures, power factors, and other parameters. The nerve center will be housed in the control tower and allows the operator there to observe and adjust all settings to ensure optimal performance at all times. There are numerous sensors at key points throughout the crushing system, and they are all linked to the control program for real-time monitoring and control. Everything will be centralized and configured to allow a single person to operate the entire system from one station.

The power generation building

The entire crushing plant and its associated conveyors are all run by electrical motors; as such, there is a need for a large industrial power generation unit on site. This facility will house two (2) large industrial generators which support all of the operations of the crushing plant. They will always be two (2) generators on standby in the event that any other unit goes down for scheduled or unscheduled maintenance; the power demanded by the crushing plant and auxiliary operations may be met at a moment's notice so that operations and production may continue uninterrupted.

Fuel Storage Bond

A Fuel Storage bond will be constructed to house all the fuel consumption needs of the

proposed Quarry.

Central Social Building

The main facility for the workers, managers, and executive management, will contain all modern amenities and conveniences, which makes it completely self-sustaining. The kitchens, bars, dining areas, and recreational facilities within this building will be maintained at the consideration of the company for its' workers and would not run for profit.

Workers quarters and accommodations

The quarry will have a rotating staff contingent that sees approximately 50 persons on-site at any given time. These workers will be provided with accommodation and housing in complexes that are continuously being maintained and upgraded by Karani Quarry Workers are not required to pay for the use of these facilities. Each building is fully outfitted to adequately meet all the needs of its occupants. All infrastructure being created by Karani Quarry has been designed and built to merge with the surrounding landscape to both enhance and preserve the natural environment as much as possible

Laundry Facility

To relieve the domestic pressures on the workers in the quarry, the company will establish a fully equipped and staffed laundry department. This service is provided at the consideration of the company and carries no additional cost to the workers who may use this facility on a daily basis.

Machine and mechanic shop

There will be a large and fully equipped mechanical division within the mine site, with an accompanying fabrication and machining division. Any and all heavy-duty machinery on-site may be dismantled, serviced, repaired, and reassembled on-site in this mechanical shop. Also, all of the cutting, welding, and fabrication is also done by experienced and professional welders on site. In addition, a division for electricians and auto-electricians to handle all of the work required on-site to keep the electrical motors, generators, alternators,

and other electrical equipment in the mine in serviceable condition.

General Stores Building

The nature of the operations at the quarry will require that a large and well-stocked inventory of spares be maintained on-site to prevent downtime. These spares and supplies are kept in the general store's department of the quarry, where the inventory and stock balance are closely monitored.

The Police Outpost located on the quarry site

The nature of the Quarry operations centers on the use of explosives to free the rocks from the ground so that they may be harvested for crushing. Karani Quarry, under the guidance of the Guyana Police Force, will construct an on-site magazine to store its explosives and detonators. The company will also establish and maintains a fully self-contained outpost to accommodate a contingent of police officers on-site at the magazine to safeguard the facility.

Medical Centre

A doctor will be situated on-site to ensure the health and minds of all employees are in great shape. A 25' x 20' structure will be erected to facilitate the medical needs of staff. In addition, medical outreach will be provided to those working in the vicinity as well.

22.0 Capital and Cost Estimates

22.1 Capital Cost Estimates

Life –of –Mine (LOM) Project Capital is summarized in Table 18. The initial capital cost is USD $3.71 Million.

ITEM	COST (GUY$)
Plant, Machinery, and Equipment	$639,500,000.00
Mine development expenses	$50,000,000.00
Building and civil works	$10,000,000.00
Furniture and Fixtures	$10,000,000.00

Reclamation & Closure	$20,000,000.00
TOTAL	**$729,500,000.00**
NET INITIAL WORKING CAPITAL	**$100,000,000.00**
PROJECT COST	**$829,500,000.00**
USD COST	**$3,753,393**

Table 18. Initial Capital Cost

22.2 Operating Cost Estimates

LOM operating costs are summarized in Table 19. Operating costs are estimated at USD

12.72 million. Open-pit mining will average USD 1.90/ ton of stone and waste moved. Processing is estimated at USD 2.16/ t ore crushed. G & A costs are estimated at USD 1.41/t ore and waste moved.

Cost Item	**LOM Costs $USD**	**Unit Cost $/ton-moved (USD)**	**Unit Cost $/ton- crushed (USD)**
Open Pit Mining	3,204,508.33	1.90	
Open Pit Drilling & Blasting	3,490,052.96	2.07	
Processing	3,643,575.01		2.16
G & A	2,380,952.38	1.41	
Totals	**12,719,088.68**	**5.39**	**2.16**

Table 19. Operating Cost

Open-pit mining costs are estimated for the total amount of fresh rock mined. Open-pit drilling and blasting costs had to be separated from these costs and applied to the total fresh rock mined.

24.3 Financial analysis

Economic Results are summarized in Table 20; the analysis suggests the following conclusions

assuming no gearing:

Mine Life: 5 Years

Pre-Tax NPV1%: USD $42,070,662

Post Tax NPV1%: USD

$32,451,624

Pay-Back Post Tax: 1 year

Total Taxes Paid: USD $9,619,038

Peak Funding of Initial Project Capital: USD 12,719,088

	Year 1 (GUY$)	Year 2(GUY$)	Year 3 (GUY$)	Year 4 (GUY$)	Year 5 (GUY$)
SALES	**$ 1,980,000,000.00**	**$ 1,999,800,000.00**	**$ 2,019,798,000.00**	**$ 2,039,995,980.00**	**$ 2,060,395,939.80**
Operating cost	($150,000,000.00)	($151,500,000.00)	($153,015,000.00)	($154,545,150.00)	($156,090,601.50)
GROSS PROFIT	$ 1,830,000,000.00	$ 1,848,300,000.00	$ 1,866,783,000.00	$ 1,885,450,830.00	$ 1,904,305,338.30
Administration, Rehabilitation and other expenses	$100,000,000.00	$100,000,000.00	$100,000,000.00	$100,000,000.00	$100,000,000.00
NET PROFIT BEFORE TAX	$ 1,730,000,000.00	$ 1,748,300,000.00	$ 1,766,783,000.00	$ 1,785,450,830.00	$ 1,804,305,338.30
Provision for taxation 20%	$396,000,000.00	$399,960,000.00	$403,959,600.00	$407,999,196.00	$412,079,187.96
PROFIT / (LOSS) AFTER TAX	**$ 1,334,000,000.00**	**$ 1,348,340,000.00**	**$ 1,362,823,400.00**	**$ 1,377,451,634.00**	**$ 1,392,226,150.34**
USD PROFIT/LOSS After tax	$ 6,352,380.95	$ 6,420,666.67	$ 6,489,635.24	$ 6,559,293.50	$ 6,629,648.33

Table 20. Cash Flow Analysis at $30 USD per ton

25.0 Prefeasibility Study Conclusions

25.1 Geology and Resources

- Exploration work was professionally managed, and field procedures generally met accepted guidelines and will be continuously updated with a drilling program
- The current production data is a clear indication of the ore deposit in the area
- The Karani Quarry project is estimated to be 1.8 million tons of Quarry material inferred based on assay and production data.

25.2 Open Pit Mine Conclusions

- The near-surface mineralization at the Karani Quarry project is amenable to conventional loader/truck mining methods utilizing 4.2 m^3 front end loaders, 1.5 m^3 hydraulic excavators, and 43.5 tons' class articulated trucks.
- Financial modeling of the open pit has determined that the open pits are economically viable and supports proven reserves—the open pit reserves 1.8 million tons of stone.
- Open Pit development includes haul road construction and pre-stripping in 2021. Quarrying will start in 2022.
- The open pit will supply at least 330,000 tons per year.
- The total mining rate for the open pits will average 942t/d over the LOM.
- The total LOM capital is estimated at USD 12.719 M.
- The average operating cost of the open pit will be USD 7.65 per tonne crushed.

25.3 Mineral Processing

- The Mobile Crusher is the Primary source of crushing the rock after being blasted.
- One thousand tons of material can be processed in a day.
- Five thousand tons shipped every day.

25.4 Infrastructure

- Proper logistics planning will play a key role in supporting the construction and operation of the project;
- Hydrological studies of the proposed Waste pile area are essential before construction starts;

- The hydrological assessment shows that average annual precipitation of over 1900 mm is expected at the project site. Diversion channels and collection/ settling ponds are essential for controlling and handling surface runoff.

25.5 Environmental and Social Conclusions

- The project's area of influence (AOI) has been significantly impacted by historical logging and hunting for well over a hundred years;
- Large fauna that is otherwise common in pristine habitats along similar types of rivers in this area of South America are absent or rare in the project AOI and may be viewed as a key indicator of significant historical human impact;
- No rare, threatened, or endangered species have not been observed in the area of the project;
- There are no formal or established communities or settlements in the immediate vicinity of the Karani Quarry site, and the project is not expected to generate direct socio-economic effects;
- There is no evidence of indigenous hunting activity within the proposed mining area;
- Results of geochemical testing to date indicate that project overburden and waste rock has very low acid rock drainage (ARD)/metals leaching potential;
- The project will develop and implement a comprehensive Environmental Management Plan (EMP).

26.0 Social and Environmental Aspects

26.1 Environmental Studies

Karanii Quarry will carry out its operations in an environmentally responsible manner and will address all pertinent issues to ensure proper stewardship of public lands and the preservation of wildlife. A separate environmental assessment will be completed to further address the following and other issues of environmental concern. Details of the environmental mitigation measures to be employed at the mining will be provided in the Environmental Management Plan (EMP). The EMP will address the potential impacts of the design, construction, operation, and closure phases of the mining.

Air Quality: Dust and diesel emissions are the main elements of air quality concerns at the mining. To limit dust formation during mining and transport of materials at the site, water will be periodically sprayed on roadways, process areas, and accessible working faces. Dust suppressants will also be used as required. Appropriate speed limits (30-15 mph) will be enforced within the mining and access road to limit fugitive dust, and spray bars will be installed at several points on crushing equipment to limit dust generation. Combustion emissions will result from the use of diesel and gasoline-fueled equipment. Due to the small nature of the operation and the small number of heavy equipment to be used, minor changes in air quality resulting from equipment emissions are anticipated. Fueled equipment will be maintained according to the manufacturer's manual and kept in good working order.

Fire Safety and General Safety: Approved fire extinguishers will be located on all pieces of mobile equipment and in-process control rooms. Heavy equipment and water will be available on-site to assist in firefighting. Police and emergency medical services are readily available. All employees will be trained in proper emergency response, incident reporting, and general health and safety. The emergency response plan will outline the measures to respond to possible emergencies such as the unintended release of hazardous materials, fire, and accidents at the site. Keriti Quarry would also ensure that all employees are trained in emergency response scenarios.

Karani Quarry will maintain an emergency response outfit, which will be located at a strategic location within the Mine Site and equipped with communication equipment as well as equipment to respond to potential emergencies. The outfit will have the following equipment readily available at their disposal for emergency response:

- Designated evacuation vehicle; boat. Transport vehicles will be provided with emergency communication equipment.
- Earth Moving Equipment.
- Pumps.
- Earthen gravel; sand, clay.
- Booms and absorbents.

In the event of an emergency, an emergency alarm will be raised to alert all persons likely to be affected and to summon the emergency coordinator and crew. All personnel within the affected area will be evacuated to an established emergency assembly point. Emergency assembly areas will be clearly identified and communicated to all employees and visitors of the mine site.

In the event of a spill, the spill response and clean-up procedures will be initiated. If there is a release of fuel oil or other hazardous material, all persons living downstream and downwind of the release will be notified. Spills will be contained by deploying relevant equipment such as booms in water and earthen material on land. In the event of a fire, water and/or other fire suppressants shall be used. In the event of an accident, a first aider will render first aid care. The emergency response coordinator will make contact with Bartica Public Hospital and inform them of the estimated time of arrival of the injured person. Details of the injuries sustained and the state of the injured will also be communicated. The Coordinator will complete an accident report to be provided to the hospital on the arrival of the injured. Emergency contact numbers/radio frequencies/satellite phone numbers/etc. and for identified medical personnel, hospital, and police will be clearly posted at the mine and camp. An accident report will be prepared to describe the cause and nature of the accident and the remedial actions taken to prevent the reoccurrence of the accident. This report will be forward to the relevant regulatory agencies on request. For effective implementation of the EMP and for a safe and healthy work environment, training will be provided to all workers. A site induction will be conducted for all new workers. This policy will ensure that employees become familiar with potential hazards and precautionary safety measures in a mining environment. The training program will be coordinated and implemented by the Environmental Manager.

Hazardous Materials: Diesel fuel and lubricants will be the major hazardous materials present at the mining site. Care will be taken so that equipment lubricants, fuels, and other industrial liquids do not drip or flow onto natural surfaces. Waste oil, other related fluids, filters, oily rags, etc., will be collected and disposed of properly. Large metal refuses containers will be positioned at the site for the collection of hazardous waste materials.

Hazardous Waste: No hazardous waste is produced at the mining. Any waste rock products will consist chiefly of biotite, quartz, muscovite, and plagioclase.

Mine Safety: The mining will be inspected periodically and will operate under applicable EPA and Guyana safety and health regulations. All employees will receive initial training before commencing work and annual refresher safety training. Impacts from blasting will be mitigated by:

- Ensuring prescribed procedures for blasting are followed, which include (1) assessing the type of rock formation, (2) determining the depth of drill holes, and (3) determining the Frequency of Blasting and Type of Explosives used.
- Careful design of the blast sequence and ensuring detonation is designed using appropriate delay intervals for charge ignition to avoid detonation of large unconfined charges and to reduce air-blast and vibration effects. The use of electronic detonators will also be employed to reduce vibrations. The number of explosives used in the blast will be carefully administered to reduce fly rock.
- Ensuring that blast safe zones are established during blasting.
- Strict procedures for transport, storage, and handling of explosives and blasting will be implemented in accordance with Mining regulations and the GGMC Code of Practice for Mining.
- A Certified Blaster will be recruited to supervise the blasting exercise, as required by law.
- Blasting will be done according to the Blasting Plan approved by the GGMC.

Blasting: Blasting will periodically be required at the Mine site. All blasting will be conducted by qualified individuals in compliance with Guyana Laws. A buffer zone was created for the blasting radius at a minimum of 500 meters. Blasting will occur only during workdays during daylight working hours such as to minimize impact to the surrounding area. Noise limiting methodologies will also be used to lessen noise impact. Stakeholder consultations will be conducted with communities such as the residents of Mile 35 and 47. Stakeholder engagement is an ongoing process of sharing information and knowledge, seeking to understand the concerns of others, and building relationships based on collaboration and partnership. Developing relationships with stakeholders is a long-term process, which will take place throughout the lifetime of the mine. The ultimate aim is to engage stakeholders as part of the project process to ensure that issues and concerns can be dealt with as quickly as possible, thereby avoiding any potential conflict and building a general sense of goodwill towards the project.

Vibration and Noise: In addition to blasting, other mine operations, including mechanical excavation, crushing, and processing, can produce significant noise and vibration. Best available practices of noise and vibration reduction will be utilized at the mining, and noise monitoring will be conducted during initial mine operations. The project's operations will be associated with noise

and vibration generating activities – excavation with machinery, drilling, and blasting of rock, transport of ore within site, and loading of trucks are the critical noise-generating activities. Excessive noise can affect workers and give rise to hearing loss, sleep disturbance and can also affect wildlife within the project area.

Noise will be mitigated by installing sound suppression equipment on vehicles, e.g., mufflers, and ensuring vehicles are maintained according to the manufacturer's manual and are kept in good working order. Operators will be equipped with PPEs such as air plugs or earmuffs. Generators will be installed with soundproofing or at a safe distance away and downwind from the living quarters. Blasting will be implemented in accordance with Mining regulations and the GGMC Code of Practice for Mining. Careful design of the blast sequence and the use of electronic detonators will be employed to reduce vibrations. Mining operations will comply with the decibel limits outlined in the GNBS Noise Emission Standard.

General Housekeeping: Operational litter will be collected in appropriate containers and removed as required from the site. No waste will be buried on site. A septic system on the land will be utilized

Waste and Ablution Facilities: Project activities are expected to produce both liquid and solid waste, which, if not properly stored and or disposed of, can lead to pollution of receiving water bodies or accumulate on-site, creating an unhygienic and un-aesthetic environment. Improper management of domestic waste and sewage can pollute land and water resources in the area, resulting in health impacts on the site. Waste generated will be collected, segregated, stored, and transported to an on-site landfill constructed in accordance with the EPA Guidelines for establishing landfills. Domestic wastewater will be directed to a soak-away filter treatment system prior to discharge to the nearby creek. Discharges to the creek will be in accordance with the EPA domestic wastewater discharge limits. All sewage will be directed to septic tanks with filter bed treatment installed.

Floral Resources: The removal of vegetation for mine site operations will alter the availability of food and shelter for wildlife. Mining may impact biodiversity by changing species composition and structure and may provide access to previously isolated areas, thereby enabling the exploitation of biological resources from the area. Imported species, including weedy plants and insect pests, may thrive while native species may decline. Improved access to the mine site areas may result in increased hunting, logging, and land development.

Emission impacts upon plants may include changes in leaf structure, which may include chlorophyll destruction (chlorosis), tissue death (necrosis), and pigment formation. Visible symptom patterns may result from either acute or chronic exposures. An acute injury may result from brief exposures (several hours) to elevated levels of a pollutant. Tissue necrosis is generally the dominant symptom pattern from acute exposures. Chronic plant injury may result from intermittent or long-term exposures to relatively low pollutant concentrations, with chlorophyll destruction or chlorosis as the principal symptom of injury. These are moderate impacts (long-term, moderate severity, local extent).

These impacts will be mitigated by employing the following measures:

• Employing dust suppression technique such as applying water or non-toxic chemicals

• Maintaining construction equipment according to manufacturer's specifications

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

Traffic on the access road and mine service roads during the operation phase would impact the early succession/edge and secondary forest habitats located along these roads by increasing dust, which will settle on vegetation. Given the limited geographic scope of this impact, the impact of dust accumulation on plants would be low (medium-term, low severity, local extent). Wetting roads during the dry seasons would reduce this impact to low (short-term, low severity, local extent).

The project may use equipment that was previously used on other projects. Soil pathogens, insects, and fungi can be introduced from these items unless stringent measures are taken to avoid this possibility. These are moderate impacts (long-term, high severity, local extent). These impacts will be mitigated by having all equipment fumigated prior to deployment to the mine site. This will result in low impacts (short-term, low severity, local extent).

The movement of people, equipment, and materials to the mine has the potential to cause the introduction of alien invasive species of plants. The disturbance and clearing of natural habitats can also promote the growth or colonization of alien invasive species. This impact is rated as moderate (long-term, moderate severity, local extent). These impacts will be mitigated by the implementation of the following mitigation measures:

• Monitoring of biodiversity and,

• Control of invasive species.

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

Faunal Resources: During operation, additional loss of habitats will not affect any threatened or restricted-range endemic species of fauna since much of the fauna will have likely already left the affected habitats due to disturbance during the construction phase. This impact is rated as moderate (medium-term, moderate severity, local extent). These impacts will be minimized by the implementation of the following:

• Minimization of the Project footprint and,

• Initiating restoration as soon as practicable in temporary work areas.

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

Most of the larger animals would have already abandoned the area during the construction phase. Only small fauna accustomed to disturbed environments is likely to remain in or enter mining areas and other work sites during the operation phase. It is likely that small numbers of small animals such as amphibians and snakes will experience mortality due to equipment and vehicle use. The loss of terrestrial fauna during the mining operations phase is rated as moderate (long-term, moderate severity, local extent). These impacts will be mitigated by the implementation of the following:

• Minimization of the Project footprint and

• Performance of pre-clearance surveys.

The movement of people, equipment, and materials to the mine has the potential to cause the introduction of alien invasive species of animals. This impact is rated as moderate (long-term, moderate severity, local extent). These impacts will be mitigated by the implementation of the following mitigation measures:

• Monitoring of biodiversity and

• Control of invasive species.

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

During the operation of the mine, wildlife may move away from the area. This displacement will increase competition with wildlife on the periphery of the area. This is a moderate impact (medium-term, moderate severity, local extent). This impact cannot be mitigated.

Wildlife species live in communities that depend on each other. The survival of these species depends on soil conditions, local climate, altitude, and other features of the local habitat. Mining operations will result in direct and indirect impacts on wildlife. The impacts will stem primarily from disturbing, removing, and redistributing the land surface. Most of these impacts would be short-term and would be confined to the mine site. Mining operations will displace and possibly destroy wildlife in areas to be excavated and to be used for the disposal of mine wastes. The mobile wildlife species, like game animals, birds, and predators, will leave these areas; however, the more sedentary animals, like invertebrates, many reptiles, burrowing rodents, and small mammals, may be more severely affected.

Aquatic Resources: The operation of the mine and associated infrastructure will impact various stream habitats within the concession area. These habitats will have already been affected by construction phase activities, but the initiation of mining operations will bring additional impacts to these affected aquatic habitats. Impacts to aquatic habitats associated with the operation of the open pit area, the tailings pond, and other areas where major conversion of the land surface occurs will be unavoidable due to the nature of the activities.

The loss of aquatic habitats in the concession area is a high impact (long-term, high severity, regional extent). Mining operations will include relocation of streams. Several of these streams may contain fish, aquatic invertebrates, and amphibians. The relocation of these streams may result in the loss of these aquatic resources. This will reduce food supplies for predators which feed on these aquatic resources, which may result in the reduction or disappearance of these predators. These are high impacts (long-term, high severity, regional extent). These impacts will be mitigated by minimizing the number and longitudinal extent of streams to be relocated. The mitigation measures will result in moderate impacts (short-term, moderate severity, local extent).

Forest Resources: The concession is located within an area of undulating terrain covered with tall evergreen ombrophiles forest in the Guiana Shield forest region with elevations ranging between 300 – 1200 m. According to ter Steege (2000), this forest region is found on soils developed on the crystalline shield, such as granites and greenstones, and on pockets of Plio-Pleistocene sediments. Rainforests of the region fringe the savannahs and are characterized by a high abundance of Goupia

glabra, Couratari, Sclerolobium, Parinari, Apeiba, Peltogyne, Catostemma, Spondias mombin, and Anacardium giganteum. Other notable species of this region are Parkia, Ficus, Sclerolobium, Trichilia, Parkia, Parinari and Goupia. Eperua falcata is characteristic of the late secondary forest, while Pterocarpus and Macrolobium acaciifolium are common in forests along rivers in this area.

None of the five primate species recorded in the project area serve as a source of proteins for persons within the concession. Two species of birds, namely, Tinamus major (Great Tinamou) and Crax elector (Powis), are used as sources of protein. However, these were not collected within the area designated for the project.

26.2 Permitting Considerations

The Karani Quarry project was granted for quarry materials. The discovery of quarry potential in the area and the necessary mineral right has been requested. An Environmental permit will be obtained from the Guyana EPA before the commencement of mining and processing operations at the Karani Quarry site. Several other permits will be obtained from the regulatory government agencies prior to the commencement of full-scale mining operations:

- Permit to transport, store, handle and use explosives (GGMC and Guyana Police Force);
- Permit to operate new Helipad (Guyana Civil Aviation Authority); and
- Permit to operate solid waste landfills at the Karani Quarry Mine site (Guyana EPA, Ministry of Health, Central Housing and Planning Authority).

26.3 Social or Community Impacts

This project site is not in close proximity to any established community. There are no known archeological sites or areas of significant cultural interest within the project concession. However, any artifacts or items of potential historical, archeological, or anthropological interest that may be found during the life of the project will be handed over to the Guyana National Trust and Ministry of Culture.

26.4 Reclamation and closure

Reclamation at the Karani Quarry Site will proceed concurrently with mining wherever possible and shall be conducted in accordance with reclamation guidelines. As valuable material is mined

out, those areas not to be affected by future quarrying operations will be reclaimed. Although it will be impossible to restore the land surface to its exact original configuration, it should be possible to reclaim the disturbed surface such that it closely matches the natural surface expression of adjacent undisturbed land. At closure, most pit walls will be reduced to a safe slope by such mechanisms, as illustrated in the figure below

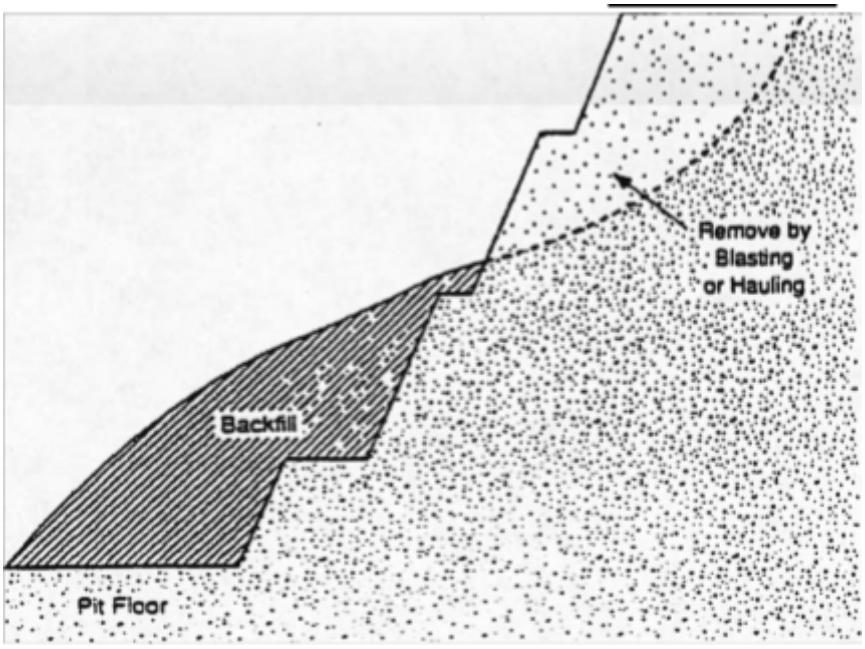


Figure 23. Example of Limited Backfilling

Appendix I: Blasting Calculations

Burden Calculation					
B= Burden (ft)					
Ks = Correction factor for geologic structure	0.85				
Kd= Correction factor for rock deposition	1				
De = Diameter of Explosive (in)	2.5				
S.Ge = Specific Gravity of Explosive	1.2				
S.Gr = Specific gravity of Rock	2.5				
B = ks x kd [3.15 De (Sge/SGr)^0.33] x [1+0.016(SGr -2)] x [1+0.014 (Sge-0.8)]					
B =	0.85	6.181020312	1.008	1.0056	5.32555 5234
Burden (Ft)	**5.3**				

Spacing Calculations:	
S = Spacing (ft)	
L = Bench Height (ft)	32.8
B = Burden (ft)	5.3
S = (L+7B)/8	
S =	8.759860829
Spacing (ft)	**8.8**

Stemming Calculations	
T = Stemming (ft)	
B = Burden (ft)	5.3
T = 0.7 x B	
T =	3.727888664
Stemming (ft)	**4**

Subdrilling Calculations	
J = Subdrilling (ft)	
B = Burden (ft)	5.3
	J = 0.3 x B
J =	1.59766657
Subdrilling (ft)	**1.6**

Hole depth Calculations			
H = Hole depth (ft)			
B = Burden (ft)	5.3	J = Subdrilling (ft)	1.6
T = Stemming (ft)	4	L = Bench Height (ft)	32.8
Ve = Velocity of Explosive (ft/s)	21293		
Vr = Velocity of Rock (ft/s)	22966		
	H = (2.5 x Ve x B + T)/ Vr	H = L + J	
H =	46.01710879	34.4	
Hole Depth (ft)	**46**	**34.4**	

Explosive Weight per Hole			
EXP = Explosive Weight (lbs)			
L = Bench Height (ft)	32.8		
De = Diameter of Explosive (in)	2.5		
S.Ge = Specific Gravity of Explosive	1.2		
J = Subdrilling (ft)	1.6		
T = Stemming (ft)	4		
	EXP = 0.3405 x SGe x De^2 x (L+J -T)		
EXP =	78.32294533		
Explosive Weight (lbs)	**78.3**	**35.6**	Kg

Volume of Rock Blasted Per Blasthole	
YD^3 = Cubic Yards broken	
L = Bench Height (ft)	32.8
B = Burden (ft)	5.3
S = Spacing (ft)	8.8
	Yd^3 = (BxSxL)/27
Yd^3 =	56.67247497
Cubic Yards Broken (ft)	56.7

Power Factor Calculation	
PF = Powder Factor (lb/yd^3)	
EXP = Explosive Weight (lbs)	78.3
V = Volume (yd^3)	56.7
	PF = EXP/V
PF =	1.382027966
Powder Factor (lb/yd^3)	**1.38**

Timing Between Holes	
tH = Hole to Hole delay (ms)	
TH = Delay constant hole to hole (from Konya, table 6.5 page 106)	1.3
S = Spacing (ft)	8.8
	$t_H = T_H \times S$
tH =	11.38781908
Hole to Hole delay (ms)	**11.4**

Timing Between Rows	
tR = Time delay Between rows (ms)	
TR = Time delay between rows (from Konya, table 6.6A, page 107)	3.5
B = Burden (ft)	5.3
	$t_R = T_R \times B$
tR =	18.63944332
Time delay between rows (ms)	**18.6**

Particle Velocity		
PV = Particle Velocity (in/sec)		
D = Distance to Area of concern (ft)	500	
EXP = Explosive Weight (lbs)	78.3	
	PV = 182 x (D/√EXP)^-1.83	
PV =	182	0.000622004
PV=	0.11320477	
Particle Velocity (in/sec)	**0.1132**	

Fragmentation Calculation: Index of Uniformity		
n= Index of Uniformity		C = H-T
D = Hole diameter (mm)	76.2	34.4
W = Standard Deviation of drilling Accuracy (m)	0	30.7
B = Burden (m)	1.6	9.3
L = Bench height (m)	10.00	A = S/B
C = Charge Length above grade level (m)	9.3	1.6

A = Spacing/Burden Ratio		1.6		
n = [2.2 – 14(B/D)] [1-(W/B)] [1 + {(A-1)/2}](L/C)				
n =	1.901768907	1	1.322436389	0.935054204
n=	2.351631782			
Index of Uniformity =	**2.4**			

Rosin Rammler Curve			
R = Proportion of material retained on screen			
x = Screen size (in)	0.4		
xc= Empirical constant	29.57		
n = index of uniformity	2.4		-(x/xc)*n
	$R = e^{-(x/xc)n}$		-0.031811049
R =	0.9686896		
Proportion of material retained on screen	**0.9687**		

Flyrock Maximum Distance and Size			
Lmax = Maximum Flyrock distance from blast (m)			
d = Hole diameter (in)	3		
Φ = maximum flyrock fragment size			
	$L_{max} = 260d^{2/3}$ (m)		$\Phi = 0.1d^{2/3}$ (m)
Lmax =	540.821794	Φ =	0.208008382
Maximum flyrock Distance	**540.8**	**Flyrock Fragment size**	**0.21**

Pit Limits	
a = angle of dip of rock	85
b = pit slope angle	55
h = depth of pit	100
ds = pit limint	

	ds = (h / tan a) + (h / tan b)	
ds =	556.8514865	
Pit Limit	**557**	

Appendix II: Equipment Specification

Dealer Retail	$83,340 - $99,110
Dealer Trade	$66,200 - $78,400

ENGINE SPECIFICATIONS

Engine Type	DIESEL TURBO F/INJ
Engine Size	4.5L
Cylinders	DIESEL TURBO V8
Max. Torque	650Nm @ 1600rpm
Max. Power	200kW @ 3400rpm
Pwr:Wgt Ratio	74.1W/kg
Bore & Stroke	86x96mm
Compression Ratio	16.8
Valve Gear	DUAL OVERHEAD CAM

DRIVETRAIN SPECIFICATIONS

Transmission	6 SP AUTOMATIC
Drive Type	4x4
Final Drive Ratio	3.909

FUEL SPECIFICATIONS

Fuel Type	DIESEL
Fuel Tank Capacity	138 Litres

Figure 24. Toyota Land cruiser Specs

Specifications for
2000 Gallon Water Truck
New 2013 Ford F750

Chassis Specifications	
Make|Model:	Ford F750 (or comparable chassis)
Year:	2013
Engine:	ISB Cummins w/200 Hp-520 ft/lb torque (or comparable), must meet current California Emission Standards
Transmission:	6-Speed Manuel Transmission (Allison or comparable)
Drivetrain:	Rear-Wheel Drive
Wheel Base	158" (or comparable)
Front Axle:	20,000lbs
Rear Axles:	46,000 lbs
GVW:	33,000
Suspension:	TufTrac (or comparable)
Brakes:	Air
Wheels:	Aluminum
Fuel Tanks:	50 Gallon Diesel Fuel, Small D.E.F. Tank.
Options:	A/C P/S Power Windows and Locks AM/FM Radio (with Auxiliary Jack) Driver and Passenger non-suspension bucket seats 97 db audible back up alarm
Paint:	Cab White
Bumper:	Front Rear push Block with integrated reel storage compartment in the rear
Manufacturer Warranty:	Companies minimum standard Coverage of Parts & Labor

Equipment Specifications	
Water Tank:	• 2,000 Gallon Capacity with cross baffle • 3/16" Steel Tank with Epoxy Coating • Baffles are construction with 7 guage ASTM-A-36 steel of better. • Tank shape is modified ellipse with flat sides for both a lower center of gravity and a flat space for graphics. • 24" diameter manway with 2" ring. • Rear ladder with non-slip steps for access to manway in tank
Sprays:	• 2 – Front • 1 – Left Side • 1 – Right Side • 2 - Rear

Figure 25. Water Truck Specs

Special Arrangements

Purpose-built for performance

D8R Desert Arrangement

Caterpillar offers a package of options ideally suited to enhance machine performance in extremely sandy or abrasive underfoot conditions.

- Copper nickel core radiator for added cooling performance.
- Specially coated fan and radiator help resist abrasion.
- Core protection grid.
- Sealed bottom guard and added seals to help keep fine abrasive particles out of components.
- Optional wear plates can be replaced to give you longer blade life when working in abrasive conditions.

D8R WH (Waste Handler)

Whether building or closing cells, pushing trash or spreading cover, the D8R WH is designed and built from the frame up to take on the unique challenges of landfill work.

- Specialized guarding, striker bars and seals help protect the machine from impact and airborne debris.
- Bottom and Final Drive guarding help prevent debris from wrapping around or damaging vital components.
- The cooling system is designed for high debris environments, with easy access for cleanout.
- Lights are mounted up and away from main debris area for protection, while still giving you plenty of light on the work area.
- Specialized air intake precleaner helps deliver cleaner air to the machine.
- Landfill blades and trapezoidal-hole track shoes help you optimize your waste handler for the job.

D8R Track-Type Tractor Specifications

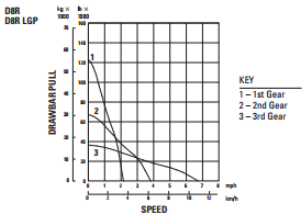
Engine

Engine Model	Cat 3406C DITA*	
Engine Power (Maximum)		
SAE J1995	252 kW	338 hp
ISO 14396	247 kW	331 hp
ISO 14396 (DIN)		335 hp
Net Power (Rated**)		
ISO 9249/SAE J1349	226 kW	303 hp
ISO 9249/SAE J1349 (DIN)		307 hp
80/1269/EEC	226 kW	303 hp
Net Power (Maximum)		
ISO 9249/SAE J1349	239 kW	320 hp
ISO 9249/SAE J1349 (DIN)		325 hp
80/1269/EEC	239 kW	320 hp
Bore	137 mm	5.4 in
Stroke	165 mm	6.5 in
Displacement	14.6 L	893 in³

*Note: Capable of meeting the equivalent of non-current U.S. EPA Tier 1 or EU Stage I emission standards.
**Rated speed 2,100 rpm.
- Net power advertised is the power available at the flywheel when engine is equipped with a fan at maximum speed, air cleaner, muffler and alternator.
- No deratings required up to 3800 m (12,500 ft) altitude.

Transmission

1.0 Forward	3.5 km/h	2.2 mph
2.0 Forward	6.2 km/h	3.9 mph
3.0 Forward	10.8 km/h	6.7 mph
1.0 Reverse	4.7 km/h	2.9 mph
2.0 Reverse	8.1 km/h	5.0 mph
3.0 Reverse	13.9 km/h	8.6 mph



NOTE: Usable pull will depend upon weight and traction of equipped tractor.

Service Refill Capacities

Fuel Tank	625 L	165 gal
Cooling System	92 L	24.3 gal
Engine Crankcase	32.5 L	8.6 gal
Power Train	144 L	38 gal
Final Drives (each)	13.5 L	3.6 gal
Pivot Shaft	40 L	2.6 gal
Hydraulic Tank	72 L	19 gal

Weights

Operating Weight – SU	37 557 kg	82,800 lb
Operating Weight – U	38 192 kg	84,200 lb
Operating Weight – A	38 374 kg	84,600 lb
Operating Weight – LGP SU	35 562 kg	78,400 lb
Shipping Weight – Standard	28 213 kg	62,200 lb
Shipping Weight – LGP	29 302 kg	64,600 lb

- Standard operating weight includes lubricants, coolant, full fuel tank, standard track, Integrated ROPS cab, air conditioner, hydraulic controls, blade, SS-Ripper and operator.
- LGP operating weight includes lubricants, coolant, full fuel tank, standard track, Integrated ROPS cab, air conditioner, hydraulic controls, SU-Blade, drawbar and operator.
- Shipping weight includes lubricants, coolant, 10% fuel tank, standard track, Integrated ROPS cab, air conditioner and hydraulic controls.

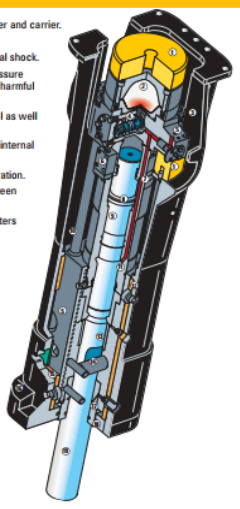
Undercarriage – Standard

Shoe Type	Moderate Service	
Width of Shoe	610 mm	24 in
Shoes/Side	44	
Track Rollers per Side	8	
Grouser Height	78 mm	3.1 in
Pitch	216 mm	8.5 in
Ground Clearance	613 mm	24.1 in
Track Gauge	2083 mm	82 in
Length of Track on Ground	3206 mm	126 in
Ground Contact Area	3.91 m²	6,060 in²
Ground Pressure (ISO 16754)	95.1 kPa	13.8 psi
Standard – SU	84.7 kPa	12.3 psi
Standard – U	86.2 kPa	12.5 psi
Standard – A	86.6 kPa	12.6 psi

Figure 26. Cat D8 dozer specs

Hydraulic Hammers for Hydraulic Excavators

1 **Shock Absorbers** – Provide maximum shock and recoil protection for both hammer and carrier.
2 **Accumulator** – Self-contained diaphragm accumulator designed for long life.
3 **Housing** – Symmetrical lean enclosed housing – no parts to break through external shock.
4 **Hydraulic valves** – The Pressure Control Valve maintains maximum hydraulic pressure to ensure that the hammer delivers all blows at full power. A check valve isolates harmful pulsation spikes from the carrier hydraulic circuit.
5 **Auto-Lube Connection and Grease Channel** – Ensures proper greasing of the tool as well as the upper and lower tool bushings.
6 **Auto Shut Off (ASO)** – Prevents blank firing and extends hammer life by reducing internal stress and heat (available only for H140D S, H160D S and H180D S).
7 **Seal carrier** – Contains special high performance seals to ensure leak-proof operation.
8 **Hydraulic brake** – Dampens idle strokes and prevents steel to steel contact between piston and cylinder.
9 **Piston** – Long piston transfers a long shock wave into the rock. Tool-piston diameters are matched for maximum energy transfer.
10 **Tie-Rods** – Heat-torqued tie rods ensure maximum clamping force and minimum maintenance.
11 **Cylinder** – Low recoil stress.
12 **& 15 Wear Plates** – High abrasion resilient plastic wear plates between hammer and housing reduce noise and guide hammer assembly properly.
13 **Upper tool bushing** – Guides the tool to optimize in-line piston to tool contact.
14 **Tool retaining pins** – Allow quick and easy tool maintenance.
16 **Rock Claw** – Special high abrasion resistant rock claw, enables quick positioning of boulders, gives maximum wear life.
17 **Lower tool bushing** – Easily replaceable during normal maintenance. Circular retention grooves retain grease and lower friction between tool and bushing.
18 **Dust Seal** – Dust Seal helps prevent foreign material from entering the housing. This reduces the wear on the lower bushing and tool.
19 **Tool** – Specially heat-treated tools match piston diameter and mass, to deliver full blow energy.

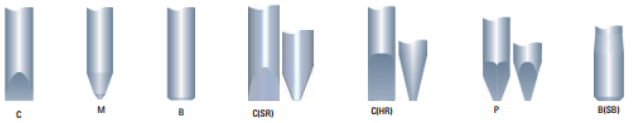


Specifications

		H115 S	H120C S	H130 S	H140D S	H160D S	H180D S
Recommended carrier weight	tonnes	12-20	17-26	19-32	25-40	32-55	40-80
Working weight*	kg	1000	1300	1700	2350	3150	3900
Impact frequency	bpm	370-800	350-620	320-600	350-600	380-560	400-575
Acceptable oil flow	liter/min	70-130	100-170	120-220	160-230	220-310	250-330
Operating pressure	bar	140	140	140	160	160	160

* Working weight includes hammer, standard tool and average mounting bracket.

Applications Guide with Standard Tools



Roadbuilding/construction	H115 S	H120C S	H130 S	H140D S	H160D S	H180D S
Breaking of road surface	C, M, P, S	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P
Breaking uneven bedrock to lay a road	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P
Primary breaking to prepare road bed				C, M, P	C, M, P	C, M, P
Trench excavation for drainage	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P
Demolition of bridges	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P
Heavily reinforced bridge pillars				B	B	B
Making holes (for traffic signs, lamp posts)	M	M	M	M	M	M
Breaking of frozen ground	C, M, P, S	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P
Demolition/housing development						
Demolition of concrete walls, roofs, floors	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P
Demolition of light, reinforced concrete foundation (<.5 m)	B, M, P	B, M, P	B, M, P			
Brick walls	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P
Rock trenches for mains/water supply/utilities	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P
Rock excavation for foundation	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P
Mass excavation of rock for industrial building bases			C, M, P	C, M, P	C, M, P	C, M, P
Massive reinforced concrete foundations				M, P	M, P	M, P
Separating rebar from concrete (for recycling)	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P
Quarrying/open cast mining						
Secondary boulder breaking	B	B	B	B	B	B
Primary breaking of rock			C, M, P	C, M, P	C, M, P	C, M, P
Breaking oversizes on a crusher/feeder/feed chute	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	B, C, M, P	
Underground applications						
Scaling	C					
Metallurgical applications						
Breaking of slag in casting ladles	C, M, P					
Breaking of slag in converter openings	C, M, P	C, M, P	C, M, P	C, M, P		
Cleaning of castings	C, M, P					
Breaking of massive steel slag					C, M, P	C, M, P
Breaking of aluminium electrolyse slag	C, M, P	C, M, P	C, M, P	C, M, P		
Other applications						
Demolition/Rock breaking under water	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P	C, M, P

C Chisel
M Moil
B Blunt
C(SR) Soft Rock Chisel
C(HR) Hard Rock Chisel
P Pyramidal Moil
B(SB) Super Blunt

Figure 27. Cat 130s Jackhammer

Engine

Engine Model	Cat C15 ACERT engine	
Net Flywheel Power	302 kW	404 hp
ISO 9249	302 kW	404 hp
SAE J1349	302 kW	404 hp
EEC 80/1269	302 kW	404 hp
Bore	137 mm	5.4 in
Stroke	171 mm	6.75 in
Displacement	15.2 L	928 in^3

- The 365C L meets EU Stage II emission requirements.
- Net power advertised is the power available at the flywheel when the engine is equipped with fan, air cleaner, muffler and alternator.
- No engine power derating required below 2300 m (7,500 ft) altitude.

Weights

Operating Weight – Long Undercarriage	65 960 kg	145,430 lb

- Reach Boom, R3.6 (11'10") stick, 1025 mm (40") bucket, and 650 mm (26") shoes.

Operating Specifications

Max Reach at Ground Level	14.04 m	46 ft
Max Digging Depth	9.64 m	31 ft 8 in
Bucket Digging Force	193 kN	43,400 lb
Stick Digging Force	256 kN	59,600 lb
Max Bucket Capacity	3.8 m^3	5 yd^3
Nominal Bucket Weight	1912 kg	4,210 lb
Bucket Digging Force – Normal	256 kN	59,600 lb

Swing Mechanism

Swing Speed	6.5 rpm	
Swing Torque	204.5 kN•m	150,850 lb ft

Drive

Maximum Travel Speed	4.1 km/h	2.6 mph
Maximum Drawbar Pull – Long Undercarriage	462 kN	103,767 lb

Hydraulic System

Main System – Maximum Flow (Total)	800 L/min	212 gal/min
Swing System – Maximum Flow	357 L/min	94 gal/min
Maximum Pressure – Equipment – Normal	32 000 kPa	4,640 psi
Maximum Pressure – Equipment – Heavy Lift	35 000 kPa	5,080 psi
Maximum Pressure – Travel	35 000 kPa	5,080 psi
Maximum Pressure – Swing	28 000 kPa	4,060 psi
Pilot System – Maximum Flow	90 L/min	24 gal/min
Pilot System – Maximum Pressure	4120 kPa	600 psi
Boom Cylinder – Bore	190 mm	7.5 in
Boom Cylinder – Stroke	1792 mm	70.6 in
Stick Cylinder – Bore	200 mm	7.9 in
Stick Cylinder – Stroke	2118 mm	83.4 in
VB Family Bucket Cylinder – Bore	180 mm	7.1 in
VB Family Bucket Cylinder – Stroke	1443 mm	56.8 in
WB Family Bucket Cylinder – Bore	200 mm	7.9 in
WB Family Bucket Cylinder – Stroke	1457 mm	57.4 in

Service Refill Capacities

Fuel Tank Capacity	800 L	211 gal
Cooling System	95 L	25 gal
Engine Oil	54 L	14.3 gal
Swing Drive (each)	12 L	3.2 gal
Final Drive (each)	15 L	4 gal
Hydraulic System (including tank)	670 L	177 gal
Hydraulic Tank	310 L	82 gal

Figure 28. Cat 365 Excavator Specs

Engine

Engine Model	Cat® C15 ACERT™	
Gross Power – SAE J1995	365 kW	489 hp
Net Power – SAE J1349	354 kW	474 hp
Net Power – ISO 14396	361 kW	484 hp
Bore	137 mm	5.4 in
Stroke	171.5 mm	6.75 in
Displacement	15.2 L	926 in^3

- The power ratings apply at rated speed of 1,700 rpm when tested under the conditions for the specified standard.
- The net power advertised is the power available at the flywheel when the engine is equipped with alternator, air cleaner, muffler and fan at minimum speed.
- Net power when the fan is at maximum speed is 321 kW (435 hp) per the SAE reference conditions.
- The 740B meets EPA Tier 4 Interim/ EU Stage IIIB emission specifications for the U.S. and Europe through 2013
- No engine derating required below 2438 m (8,000 ft).
- Peak engine torque gross (SAE J1995) 2510 N-m (1,850 lb-ft)
- Peak engine torque net (SAE J1349) 2466 N-m (1,819 lb-ft)
- Peak engine torque speed (1,200 rpm)

Weights

Rated Payload	39.5 tonnes	43.5 tons

Body Capacities

Heaped SAE 2:1	24 m^3	31.4 yd^3
Struck	18.5 m^3	24.2 yd^3
Tailgate Heaped SAE 2:1	25.5 m^3	33.5 yd^3
Tailgate Struck	19.5 m^3	25.5 yd^3

Transmission

Forward 1	8.9 km/h	5.5 mph
Forward 2	12.1 km/h	7.5 mph
Forward 3	16.4 km/h	10.2 mph
Forward 4	22 km/h	13.7 mph
Forward 5	30 km/h	18.6 mph
Forward 6	40 km/h	25.1 mph
Forward 7	54.7 km/h	34 mph
Reverse 1	8.4 km/h	5.2 mph
Reverse 2	11.6 km/h	7.2 mph

Sound Levels

Interior Cab	79 dB(A)

- The operator sound exposure Leq (equivalent sound pressure level) measured according to the work cycle procedures specified in ANSI/SAE J1166 OCT 98 is 79 dB(A), for the cab offered by Caterpillar, when properly installed and maintained and tested with the doors and windows closed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environments.

Operating Weights

Front Axle – Empty	20 664 kg	45,556 lb
Center Axle – Empty	7229 kg	15,937 lb
Rear Axle – Empty	6499 kg	14,328 lb
Total – Empty	34 393 kg	75,824 lb
Front Axle – Rated Load	5211 kg	11,488 lb
Center Axle – Rated Load	17 186 kg	37,889 lb
Rear Axle – Rated Load	17 186 kg	37,889 lb
Total – Rated Load	39 582 kg	87,263 lb
Front Axle – Loaded	25 875 kg	57,045 lb
Center Axle – Loaded	24 415 kg	53,826 lb
Rear Axle – Loaded	23 685 kg	52,216 lb
Total – Loaded	73 975 kg	163,087 lb

Body Plate Thickness

Front	8 mm	0.31 in
Scow	16 mm	0.63 in
Side	12 mm	0.47 in
Base	16 mm	0.63 in

Service Refill Capacities

Fuel Tank	560 L	148 gal
Cooling System	80 L	21.1 gal
Hydraulic System	328 L	86.6 gal
Engine Crankcase	38 L	9.5 gal
Transmission	72 L	19 gal
Final Drives/ Differential	72 L	19 gal
Output Transfer Gear Box	18 L	4.8 gal

Body Hoist

Raise time	12 Seconds
Lower time	7 Seconds

Standards

Brakes	ISO 3450 – 1996
Cab/FOPS	ISO 3449 Level II – 2005
Cab/ROPS	ISO 3471 – 2008
Steering	ISO 5010 – 2007

Figure 29. Cat 745 Truck Specs

Operating Specifications

Bucket Type Capacity, Rated (§) (nominal heaped)	General Purpose 4.5 cu. yd. (3.44 m³)	General Purpose 5.0 cu. yd. (3.82 m³)	General Purpose 5.5 cu. yd. (4.21 m³)	Rock 5.0 cu. yd. (3.82 m³)
Capacity, struck (§)	3.84 cu. yd. (2.94 m³)	4.28 cu. yd. (3.27 m³)	4.75 cu. yd. (3.63 m³)	4.74 cu. yd. (3.62 m³)
Cutting edge, type	Straight	Straight	Straight	Modified V
Width (§)	129″ (3280 mm)	129″ (3280 mm)	129″ (3280 mm)	129″ (3280 mm)
Dump clearance @ full lift and 45° discharge (§)	10′6″ (3200 mm)	10′4″ (3150 mm)	10′2″ (3100 mm)	9′1″ (2770 mm)
Reach at 45° discharge angle, 7′0″ (2130 mm) clearance (§)	5′10″ (1780 mm)	6′0″ (1830 mm)	6′1″ (1850 mm)	6′8″ (2030 mm)
Reach at full lift and 45° discharge (§)	3′8″ (1120 mm)	3′10″ (1170 mm)	4′0″ (1220 mm)	5′1″ (1550 mm)
Digging depth (§)	3.7″ (94 mm)	3.7″ (94 mm)	3.7″ (94 mm)	3.4″ (86 mm)
Overall length (§)	24′7″ (7490 mm)	24′10″ (7570 mm)	25′1″ (7650 mm)	26′6″ (8080 mm)
Overall height (§)	18′8″ (5690 mm)	19′3″ (5870 mm)	19′7″ (5970 mm)	20′2″ (6150 mm)
Loader clearance circle (bucket in carry position) (§)	47′10″ (14.6 m)	48′0″ (14.6 m)	48′2″ (14.7 m)	48′10″ (14.9 m)
Static tipping load ** Straight (§)	36,420 lb. (16 520 kg)	36,170 lb. (16 400 kg)	35,980 lb. (16 320 kg)	34,920 lb. (15 830 kg)
Full 35° turn (§)	33,210 lb. (15 060 kg)	32,950 lb. (14 940 kg)	32,760 lb. (14 850 kg)	31,670 lb. (14 360 kg)
Breakout force * (§)	35,110 lb. (15 930 kg)	32,630 lb. (14 800 kg)	30,950 lb. (14 040 kg)	26,080 lb. (11 820 kg)
Operating weight **	51,500 lb. (23 360 kg)	51,800 lb. (23 500 kg)	51,900 lb. (23 540 kg)	53,400 lb. (24 220 kg)

*Measured 4″ (102 mm) behind tip of cutting edge with bucket hinge pin as pivot point, in accordance with SAE J732c (1969).
**Static tipping load and operating weight include lubricants, coolant, full fuel tank, 26.5-25, 20 PR (L-3) tires with 3,040 lb. (1380 kg) $CaCl_2$ in rear tires, ROPS cab and operator. Machine stability is affected by tire size, ballast in rear tires or attachments. For selected items, add the following to machine operating weight and static tipping load:

	Change in Operating Weight	Change in Articulated Static Tipping Load
23.5-25, 20 PR (L-3) tires	–1,730 lb. (–790 kg)	–1,630 lb. (–740 kg)
26.5-25, 20 PR (L-4) tires with 75% $CaCl_2$	1, 310 lb. (590 kg)	1,090 lb. (490 kg)
26.5-25, 20 PR (L-5) tires with 75% $CaCl_2$	2,420 lb. (1090 kg)	2,020 lb. (910 kg)
29.5-25, 22 PR (L-3) tires with 75% $CaCl_2$	2,710 lb. (1220 kg)	2,870 lb. (1300 kg)
Counterweight	1,840 lb. (830 kg)	3,200 lb. (1450 kg)
Counterweight	1,740 lb. (780 kg)	3,440 lb. (1560 kg)
Without ROPS cab, with brackets	–1,480 lb. (–680 kg)	–1,390 lb. (–630 kg)
Canopy, ROPS	–440 lb. (–200 kg)	–379 lb. (–172 kg)

dimensions (approximate) (§)

23.5-25 Tires
Tread width ..... 90″ (2290 mm)
Width over tires ..... 114″ (2900 mm)
Ground clearance ..... 16.0″ (406 mm)
Decrease in vertical dimensions ..... 2.8″ (71 mm)

26.5-25 Tires
Tread width ..... 87″ (2210 mm)
Width over tires ..... 115″ (2920 mm)
Ground clearance ..... 18.8″ (478 mm)
Increase in vertical dimensions .... None

26.5-25 Extra Tread Tires
Tread width ..... 87″ (2210 mm)
Width over tires ..... 115″ (2920 mm)
Ground clearance ..... 20.2″ (510 mm)
Increase in vertical dimensions ..... 1.4″ (36 mm)

29.5-25 Tires
Tread width ..... 90″ (2290 mm)
Width over tires ..... 121″ (3070 mm)
Ground clearance ..... 20.8″ (530 mm)
Increase in vertical dimensions ..... 2.0″ (51 mm)

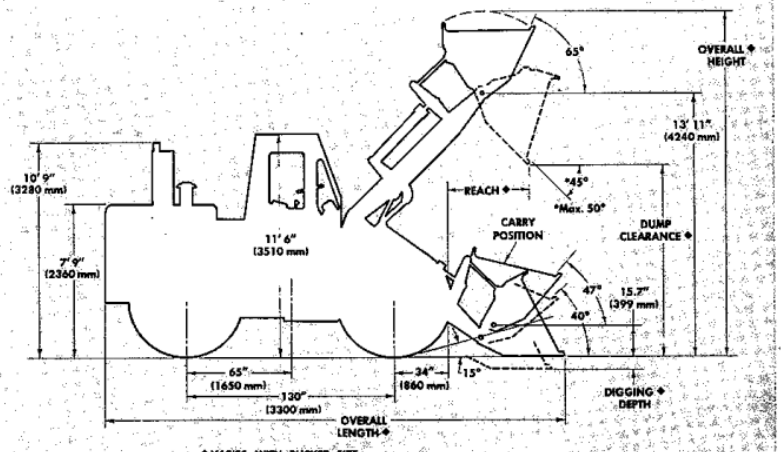


Figure 30. Cat 980B front-end Loader Specs

SPECIFICATIONS SMOOTH DRUM

	CS44B[1]	CS54B	CS56B[2]	CS64B[3]	CS66B[4]
Operating Weight					
Machine with ROPS/FOPS - kg (lb)	6943 (15,307)	10 355 (22,822)	11 290 (24,887)	–	–
Weight at the drum with ROPS/FOPS - kg (lb)	3384 (7,460)	5785 (12,754)	6255 (13,788)	–	–
Static Linear Load with ROPS/FOPS - kg/cm (lb/in)	20.2 (113)	27.1 (151.8)	29.3 (164.1)	–	–
Machine with CAB - kg (lb)	7210 (15,895)	10 555 (23,265)	11 500 (25,346)	12 055 (26,569)	12 360 (27,245)
Weight at the drum with CAB - kg (lb)	3518 (7,756)	5880 (12,959)	6350 (13,990)	7120 (15,690)	7355 (16,214)
Static Linear Load with CAB - kg/cm (lb/in)	21 (118)	27.6 (154.3)	29.8 (166.6)	33.4 (186.8)	34.5 (193)
Machine Dimensions					
Overall length - m (ft/in)	5.09 (16' 9")	5.85 (19' 2")	5.86 (19' 3")	5.85 (19' 2")	5.86 (19' 3")
Overall length with leveling blade option - m (ft/in)	5.62 (18' 6")	–	6.40 (21' 0")	–	6.40 (21' 0")
Overall width - m (ft/in)	1.8 (5' 11")	2.30 (7' 7")	2.30 (7' 7")	2.33 (7' 8")	2.33 (7' 8")
Overall width with leveling blade option - m (ft/in)	2.12 (7' 0")	–	2.50 (8' 3")	–	2.50 (8' 3")
Maximum machine height - m (ft/in)	2.85 (9' 4")	3.11 (10' 3")	3.11 (10' 3")	3.11 (10' 3")	3.11 (10' 3")
Wheelbase - m (ft/in)	2.6 (8' 6")	2.90 (9' 7")	2.90 (9' 7")	2.90 (9' 7")	2.90 (9' 7")
Ground clearance - mm (in)	411 (16.2)	442 (17.4)	442 (17.4)	442 (17.4)	442 (17.4)
Curb clearance - mm (in)	369 (14.5)	543 (21.4)	494 (19.4)	491 (19.3)	494 (19.4)
Minimum turning radius, inside drum edge - m (ft/in)	3.05 (10' 0")	3.68 (12' 1")	3.68 (12' 1")	3.68 (12' 1")	3.68 (12' 1")
Drum Dimensions					
Drum width - mm (in)	1676 (66)	2134 (84)	2134 (84)	2134 (84)	2134 (84)
Drum shell thickness - mm (in)	25 (1)	25 (1)	30 (1.18)	25 (1)	30 (1.18)
Drum diameter - mm (in)	1221 (48.1)	1534 (60.4)	1534 (60.4)	1534 (60.4)	1534 (60.4)
Padfoot Shell Kit Drum Dimensions					
Drum diameter over pads - mm (in)	1420 (55.9)	1730 (68.1)	1730 (68.1)	1730 (68.1)	1730 (68.1)
Number of pads	98	120	120	120	120
Pad height - mm (in)	89 (3.5)	90 (3.5)	90 (3.5)	90 (3.5)	90 (3.5)
Pad surface area, oval face option - cm^2 (in^2)	63.8 (9.9)	63.5 (9.8)	63.5 (9.8)	63.5 (9.8)	63.5 (9.8)
Pad surface area, square face option - cm^2 (in^2)	95.5 (14.8)	123 (19.1)	123 (19.1)	123 (19.1)	123 (19.1)
Vibratory System					
Maximum frequency - Hz (vpm)	31.9 (1914)	30.5 (1830)	30.5 (1830)	30.5 (1830)	30.5 (1830)
Nominal amplitude @ max frequency					
High - mm (in)	1.67 (0.066)	1.9 (0.075)	2.1 (0.083)	1.9 (0.075)	2.1 (0.083)
Low - mm (in)	0.84 (0.033)	0.95 (0.037)	0.98 (0.039)	0.95 (0.037)	0.98 (0.039)
Centrifugal force					
High - kN (lb)	133 (29,900)	234 (52,600)	301 (67,600)	234 (52,600)	301 (67,600)
Low - kN (lb)	67 (15,000)	133 (29,900)	141 (31,670)	133 (29,900)	141 (31,670)
Power Train					
Engine	Cat C3.4B	Cat C4.4 ACERT	Cat C4.4 ACERT[†]	Cat C4.4 ACERT	Cat C4.4 ACERT
Gross power ISO 14396 - kW (hp) @ 2200 rpm	75 (100.6)	98 (131)	117 (157)	98 (131)	117 (157)
Maximum speed - km/h (mph)	11.4 (7.0)	11 (6.8)	11.4 (7.0)	11 (6.8)	11.4 (7.0)
Tire Size	14.9 x 24	23.1 x 26	23.1 x 26	23.1 x 26	23.1 x 26
Miscellaneous					
Electrical system - volts	12	24	24	24	24
Articulation angle - degrees	37	34	34	34	34
Oscillation angle - degrees	15	15	15	15	15
Fuel tank capacity - L (gal)	150 (40)	242 (64)	242 (64)	242 (64)	242 (64)
Diesel Exhaust Fluid refill capacity - L (gal)	18.9 (5)	15 (4)	15 (4)	15 (4)	15 (4)

Figure 31. Cat Steel-roller Specs

Engine

Four-stroke cycle, four cylinder 3054T turbo-charged, diesel engine. Meets EPA and CARB emissions engine regulations.

Ratings at 2,200 rpm	kW	hp
Gross power	78	105

Ratings of Caterpillar machine engines are based on standard air conditions of 25°C (77°F) and 99 kPa (29.32") Hg dry barometer. Power is based on using 35° API gravity fuel having an LHV of 42,780 kJ,kg (18,390 Btu/lb) when used at 30°C (86°F) [ref. a fuel density of 838.9 g/L (7.001 lb/U.S. gal)]. Net power advertised is the power available at the flywheel when the engine is equipped with fan, air cleaner, muffler and alternator.

The following ratings apply at 2200 rpm when tested under the specified standard conditions for the specified standard:

Net Power	kW	hp
ISO 9249	74	100
SAE J1349 (JAN90)	74	99
EEC80/1269	74	100

Dimensions		
Bore	100 mm	3.937"
Stroke	127 mm	5"
Displacement	4 L	243 in³

Dual-element, dry-type air cleaner with visual restriction indicator.

Electrical System

The 24-volt electrical system includes 2 maintenance-free Cat batteries, color-coded and numbered wiring wrapped in nylon braid. The system includes a 45-amp alternator.

Sound Levels

The operator sound pressure level measured according to the procedures specified in SAE J919 APR95 is 82.5 dB(A).

Brakes

Service brake features

Closed-loop hydrostatic drive system provides dynamic braking during machine operation.

Secondary and parking brake features
Spring-applied/hydraulically released disc brakes are actuated by a switch on the control console. They are also activated automatically if pressure is lost in the brake circuit or when the engine is shut off. Brake systems meet SAE standard J1472 MAR92.

Transmission

Two speed hydrostatic propel system. Hydrostatic pump provides oil to two hydrostatic motors mounted above the drive axles. Drive shafts connect the motors to the axles.

A single propel lever located on the control console provides smooth hydrostatic control of the infinitely variable speeds in both forward and reverse.

PS-360B Speeds (forward and reverse):

Low	0-8 kmph (0-5 mph)
High	0-18 kmph (0-11 mph)

Axles

Each set of rear wheel pairs are mounted directly to heavy-duty planetary drives.

Service Refill Capacities

	Liters	U.S. Gallons
Fuel Tank	200	52.8
Cooling system	28	7.3
Engine oil (w/filter)	7,3	1.9
Brake	0,6	0.13
Axle	7,5	2
Hydraulic tank	90	23.7
Tire spray tank (optional)	394	104
Emulsion tank (optional)	19	5

Steering

Steering is hydraulic power-assist for responsive, low-effort machine handling.

Minimum turning radius:

Inside	3470 mm
Outside	6700 mm

Steering Angle (each direction) 38.4°
Hydraulic system
One 76 mm (3") bore, double-acting cylinder powered by a gear pump.
Output @ 1200 rpm with 689 kPa 6,8 bar (100 psi) 11,6 Lpm (3 gpm)

Wheels and Tires

14/70 x 20 12-ply tires
3 wheels front, 4 wheels rear

Each tire is equipped with a replaceable scraper. The scrapers help clean asphalt or soil off the tires. The scrapers can be positioned above the tires when they are not needed.

Rear tires extend 58 mm (2.25") outside the width of the frame. Front and rear wheels oscillate to provide uniform compaction across entire rolling width. This also ensures excellent bonding of longitudinal asphalt joints.

PS-360B specifications

Figure 32. Cat Rubber-wheel Roller Specs

ELECTRIC POWER - Technical Spec Sheet
STANDARD

C18 ACERT
520 ekW/ 650 kVA/ 50 Hz/ 1500 rpm/ 400 V/ 0.8 Power Factor

Rating Type: PRIME

Fuel Strategy: LOW FUEL CONSUMPTION

Image shown may not reflect actual configuration

C18 ACERT
520 ekW/ 650 kVA
50 Hz/ 1500 rpm/ 400 V

	Metric	English
Package Performance		
Genset Power Rating with Fan @ 0.8 Power Factor	520 ekW	
Genset Power Rating	650 kVA	
Aftercooler (Separate Circuit)	N/A	N/A
Fuel Consumption		
100% Load with Fan		
75% Load with Fan		
50% Load with Fan		
25% Load with Fan		
Cooling System[1]		
Engine Coolant Capacity		
Inlet Air		
Combustion Air Inlet Flow Rate	35.3 m³/min	1246.1 cfm
Max. Allowable Combustion Air Inlet Temp	49 ° C	119 ° F
Exhaust System		
Exhaust Stack Gas Temperature	550.5 ° C	1022.9 ° F
Exhaust Gas Flow Rate	101.2 m³/min	3572.0 cfm
Exhaust System Backpressure (Maximum Allowable)	10.0 kPa	40.0 in. water

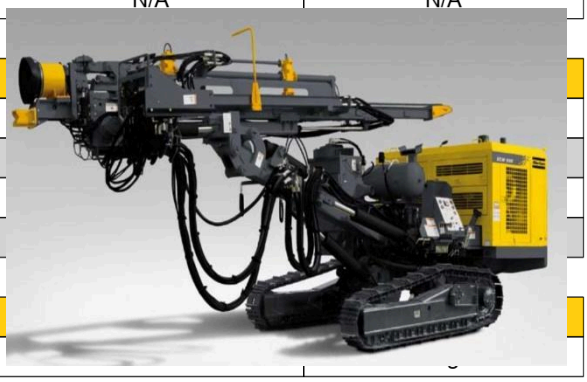


Figure 33. Cat Generator Specs

Technical data ECM 590RC		
Recommended hole range		
Hole range	64-115 mm	2½"- 4½"
Drill steel dimensions	T38,T45,T51	
Rod handling capacity		
Hole depth	22 m	72'
Hydraulic rock drill		
Yamamoto/YH80A		
Impact power, max.	16.4 kW	22 HP
Rotation speed	0-160 rpm	
Torque max.	578 Nm	426 ft.lbf
Engine		
Cummins QSB6.7		
Rating at 2350 rpm	164 kW	220 HP
Emission control level	Stage 3	Tier III
Fuel tank		
Capacity	378 l	~100 US gal.
Compressor		
Working pressure, max.	9.7 bar	140 psi
FAD (Free Air Delivery)	118 l/s	250 cfm
Boom variant		
Type	Extension	
Boom extension	762 mm	30"
Feed		
Feeding system	Chain	
Feed length, total	7 366 mm	24'2"
Travel length	4 674 mm	15'4"
Feed extension	1 219 mm	4'
Feed rate, max.	0.71 m/s	139 ft/min
Feed force, max.	23 kN	5200 lbf
Pull force, max	23 kN	5200 lbf
Tramming		
Tramming speed max.	3.3 km/h	2 mph
Traction force	81.73 kN	18 373 lbf
Hill climbing ability	30°	
Track oscillation	±10°	
Ground clearance	457 mm	18"
Transport dimensions, approximately		
Weight	11.1 tonnes	24500lb
Width	2.62 m	8'7"
Heigth	2.92 m	9'7"
Length	8.94 m	29'4"

Standard equipment

- Mechanized rod handling system
- Automatic throttle
- Fully load sense hydraulic system
- On off anti-jamming
- Pre-separator
- Dust collector
- Retractable dust hood
- Boom extension
- Feed extension
- Hydraulic centralizer
- Heavy duty tracks with full length rock guard
- Separate drill and tram consoles
- Back up alarm
- Pressurized water mist with tank
- Toe hole drilling forward
- Variable speed cooling fan (3 step)
- Ether start

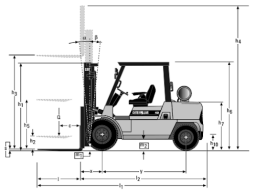
Selection of optional equipment

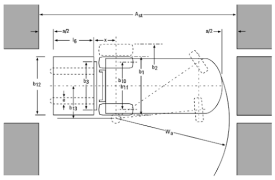
- Work lights
- Hydraulic pressure test kit
- Reverse percussion
- Winch
- Conversion kits T51/T45/T38
- Gas charging equipment

Figure 34. ECM 590 Drill Specs

	Characteristics												
1.01	Manufacturer (abbreviation)			Cat Lift Trucks		Cat Lift Trucks		Cat Lift Trucks		Cat Lift Trucks	
1.02	Manufacturer's model designation			DP40K	GP40K	DP40KL	GP40KL	DP45K	GP45K	DP50K	GP50K
1.03	Power source: (Diesel, LP Gas)			Diesel	LPG	Diesel	LPG	Diesel	LPG	Diesel	LPG
1.04	Operator type: pedestrian, (operator)-standing, -seated			Seated		Seated		Seated		Seated	
1.05	Lifting capacity	Q	(t)	4 (3.5)		4 (4.5)		4.5 (5)		5	
1.06	At load centre	c	(mm)	500 (600)		600 (500)		600 (500)		600	
1.08	Load distance	x	(mm)	557		557		562		582	
1.09	Wheelbase	y	(mm)	2000		2000		2000		2150	
	Weight										
2.01	Truck weight, without load		kg	5710	5570	6120	5970	6680	6530	7160	7050
2.02	Axle loading with rated load, front/rear		kg	8670/1040	8580/990	8860/1260	8750/1220	9740/1440	9510/1520	10710/1450	10650/1400
2.03	Axle loading without load, front/rear		kg	2560/3150	2460/3110	2550/3570	2440/3530	2620/4060	2390/4140	2960/4200	2900/4150
	Wheels, Drive Train										
3.01	Tyre type: V=solid, L=pneumatic, SE=solid pneumatic - F/R			L/L		L/L		L/L		L/L	
3.02	Tyre dimensions, front			8.25 x 15-14 PR		300 x 15-18 PR		300 x 15-18 PR		300 x 15-18 PR	
3.03	Tyre dimensions, rear			7.00 x 12-14PR		7.00 x 12-14PR		7.00 x 12-14PR		7.00 x 12-14PR	
3.05	Number of wheels, front/rear (x=driven)			2x/2		2x/2		2x/2		2x/2	
3.06	Distance between centreline of tyres, front	b10	(mm)	1175		1175		1175		1175	
3.07	Distance between centreline of tyres, rear	b11	(mm)	1180		1180		1180		1180	
	Dimensions										
4.01	Mast tilt, forwards/backwards	∂/ß	°	6/10		6/10		6/10		6/10	
4.02	Height with mast lowered	h1	(mm)	2320		2320		2400		2400	
4.03	Standard free lift	h2	(mm)	100		100		100		100	
4.04	Standard lift height	h3	(mm)	3300		3300		3300		3300	
4.05	Overall height with mast raised	h4	(mm)	4570		4570		4570		4590	
4.07	Height to top of overhead guard	h6	(mm)	2250		2250		2250		2250	
4.08	Seat height	h7	(mm)	1093		1093		1093		1093	
4.12	Tow coupling height	h10	(mm)	420		420		420		420	
4.19	Overall length	l1	(mm)	4290		4340		4395		4525	
4.20	Length to fork face (includes fork thickness)	l2	(mm)	3070		3120		3175		3305	
4.21	Overall width (single/dual tyres)	b1/b2	(mm)	1415/1965		1460/1965		1460/1965		1460/1965	
4.22	Fork dimensions (thickness, width, length)	s,e,l	(mm)	50,150, 1220		50,150, 1220		50,150, 1220		60,150, 1220	
4.23	Fork carriage to DIN 15 173 A/B/no			3A		3A		3A		3A	
4.24	Fork carriage width	b3	(mm)	1190		1190		1190		1190	
4.31	Ground clearance under mast, with load	m1	(mm)	150		150		150		150	
4.32	Ground clearance centre of wheelbase, with load	m2	(mm)	252		252		252		252	
4.33	Working aisle width with 1000 x1200 mm pallets	Ast3	(mm)	4492		4532		4582		4747	
4.34	Working aisle width with 800 x1200 mm pallets	Ast3	(mm)	4292		4332		4382		4547	
4.35	Turning circle radius	Wa	(mm)	2735		2775		2830		2965	
4.36	Minimum distance between centres of rotation	b13	(mm)	870		870		870		965	
	Performance										
5.01	Travel speed, with/without load		km/h	17,5 / 19,5	18 / 19,5	18 / 19,5	18 / 19,5	17,5 / 19,5	18 / 19,5	21,5(12,5*) / 23,5(13,5*)	21(12,5*) / 23,5(13,5*)
5.02	Lifting speed, with/without load		m/s	5.00 / 5.20	5.10 / 5.10	5.00 / 5.20	5.10 / 5.10	4.30 / 4.50	4.40 / 4.40	4.30 / 4.50	4.40 / 4.40
5.03	Lowering speed, with/without load		m/s	5.00 / 5.00		5.00 / 5.00		5.00 / 5.00		5.00 / 5.00	
5.05	Rated drawbar pull, with/without load		N	19400 / 17500	24000 / 17000	19000 / 17000	24000 / 17000	19000 / 18000	24000 / 18000	26000 / 21000	33000 / 20000
5.07	Gradeability, with/without load		%	20.6 / 27.1	26.8 / 27.4	20.5 / 25.5	25.8 / 25.2	19.4 / 24.1	23.0 / 22.3	25.5 / 26.3	29.4 / 25.7
5.09	Acceleration time, with/without load (0 -15 m)		s	N/A	N/A	N/A	N/A	N/A	N/A	4,56 / 3,99	4,70 / 4,10
5.10	Service brakes (mechanical/hydraulic/electric/pneumatic)			Hydraulic		Hydraulic		Hydraulic		Hydraulic	
	I.C. Engine										
7.01	Manufacturer/Type			MHI / S6S	TB45	MHI / S6S	TB45	MHI / S6S	TB45	MHI / S6S	TB45
7.02	Rated output B to ISO 1585		kW	60.3	72	60.3	72	60.3	72	60.3	72
7.03	Rated speed to DIN 70020		rpm	2450	2450	2450	2450	2450	2450	2450	2450
7.04	Number of cylinders/displacement		/cm3	6 / 4996	6 / 4500	6 / 4996	6 / 4500	6 / 4996	6 / 4500	6 / 4996	6 /4500
7.05	Fuel consumption according to VDI cycle		l/h / kg/h	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Miscellaneous										
8.01	Type of drive control			Powershift 1/1		Powershift 1/1		Powershift 1/1		Powershift 2/2	
8.02	Operating pressure for attachments		bar	191		191		191		191	
8.03	Oil flow for attachments		l/min	N/A		N/A		N/A		N/A	
8.04	Noise level, mean value at operator's ear		dB(A)	81	79	81	79	81	79	81	79
8.05	Towing coupling design/DIN type, ref.			Pin		Pin		Pin		Pin	

* 1st. speed





$A_{st} = W_a + x + l_6 + a$

Ast = Working aisle width with load
a = Safety clearance (200 mm)
l6 = Pallet length (800 or 1000 mm)
b12 = Pallet width (1200 mm)

Low Cost of Ownership

- Anti-clogging cooling system ensures optimal engine temperature for long life and low maintenance costs.
- High air intake in the overhead guard for reduction of maintenance.
- Tangible grease points ensure durability in the toughest environments.
- DP/GP 40K, 40KL and 45K boast capacity ratings of 500mm and 600mm.
- Quality engineering for long life, utter reliability and low handling costs.

Unmatched Productivity

- Enhanced performance and minimal noise and exhaust emissions.
- Sophisticated LPG engine management and protection system.
- Advanced fuel and ignition system reduces the need for engine tuning.
- 500 Hours service Intervals.

Safety & Ergonomics

- Range of high visibility Simplex, Duplex and Triplex masts for precise application match and safe load handling.
- Adjustable fingertip hydraulic control for effortless and precise load handling.
- Auto-light switch when entering dark spaces for safe material handling.
- Small diameter steering wheel on adjustable steer column.
- Hydrostatic steering for precise manoeuvring.

Useful Options

- Hydraulic relief valve kit.
- Brake booster filter kit.
- Greasable universal joint.
- Hi-speed fan.
- Speed limit option for LPG.
- Lockable fuel cap.

CAT Lift Trucks

Figure 35. Cat Fork Lift Specs

Nordberg NW Series Jaw Plants

Type	NW80	NW96	NW106	NW116	NW110	NW3054	NW125	NW140
Transport dimensions							*	*
Length	9 400 mm	12 000 mm	13 500 mm	15 300 mm	15 000 mm	15 100 mm	17 500 mm	17 500 mm
Width	2 500 mm	2 500 mm	3 000 mm	3 500 mm	3 500 mm	3 320 mm	3 500 mm	3 500 mm
Height	4 050 mm	3 300 mm	3 700 mm	4 100 mm	4 500 mm	4 100 mm	4 500 mm	4 500 mm
Weight	19 600 kg	26 000 kg	35 500 kg	47 000 kg	62 300 kg	58 000 kg	74 000 kg	76 800 mm
Axle weight	9 100 kg	16 000 kg	20 000 kg	30 800 kg	41 000 kg	36 500 kg	44 000 kg	46 300 kg
King pin weight	10 400 kg	10 000 kg	15 500 kg	16 200 kg	21 000 kg	21 500 kg	30 000 kg	30 500 kg
Crusher	C80	C96	C106	C116	C110	C3054	C125	C140
Feed opening								
- intake width	800 mm	930 mm	1 060 mm	1 150 mm	1 100 mm	1 375 mm	1 250 mm	1 400 mm
- intake depth	510 mm	580 mm	700 mm	800 mm	850 mm	760 mm	950 mm	1 070 mm
Setting range	40-175 mm	60-175 mm	70-200 mm	70-200 mm	70-200 mm	70-200 mm	100-250 mm	125-250 mm
Motor power	75 kW	90 kW	110 kW	132 kW	160 kW	160 kW	160 kW	200 kW
Feeder	TK8-27-2V	TK8-32-2V	TK11-42-2V	TK11-48-2V	VF561-2V	VF561-2V	VF561-2V	B16-50-3V
- length	2 700 mm	3 200 mm	4 200 mm	4 800 mm	6 100 mm	6 100 mm	6 100 mm	5 000 mm
- width	800 mm	800 mm	1 100 mm	1 100 mm	1 300 mm	1 300 mm	1 300 mm	1 600 mm

** Feeder unit removed For inches divide by 25.4 For lbs divide by 0.45 For ft³ multiply by 35.3*

Figure 36. NordBerg NW140 Mobile Crusher Specs

Appendix III: Magnafrac (Explosive) Data Sheet

Material Safety Data Sheet

Preparation Date: 24-Aug-2007 **Revision Date:** 18-Jul-2008 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.	Orica USA Inc.
Maple Street	33101 E. Quincy Avenue
Brownsburg, QC	Watkins, CO 80137-9406
For MSDS Requests: 1-450-533-4201	For MSDS Requests: 1-303-268-5000

Product Name:	**Senatel™ Magnafrac™ & Senatel™ Magnafrac™ HW**
Product Code:	107
Alternate Name(s):	Magnafrac™ & Magnafrac™ HW
UN-No:	UN0241
Recommended Use:	A detonator sensitive emulsion explosive.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Risk of explosion by shock, fire of other sources of ignition. May cause skin irritation and/or dermatitis. Irritating to eyes. Harmful if swallowed. Oxidizing agent. May cause methemoglobinemia. May cause liver damage. May cause kidney damage.

Appearance:	**Physical State:**	**Odor:**
Orange, viscous, putty-like	Viscous, putty-like	Odorless

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Ammonium Nitrate	6484-52-2	70-80
Sodium Nitrate	7631-99-4	2-12
Mineral Oil	64742-53-6	1-6

SECTION 4 – FIRST AID MEASURES

General Advice:	In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible).
Eye Contact:	Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.
Skin Contact:	Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.
Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Ingestion:	Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.
Notes to physician:	Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Not itself combustible but assists fire in burning materials. The product does not flash. Rate of burning: does not sustain burning at atmospheric pressure.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could lead to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: This product is a high explosive with mass detonation hazard. DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Contain or absorb leaking putty with sand or earth or other suitable substance.

Methods for cleaning up: Avoid the use of metal tools containing iron and/or copper. Be careful to avoid shock, friction, and contact with grit. Collect product for recovery or disposal. For release to land, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Collect contaminated soil and water, and absorbent for proper disposal. Notify applicable government authority if release is reportable or could adversely affect the environment.

Other information: Deactivating chemicals: Detergents will break up emulsions if mixed in.

SECTION 7 – HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. The use of coveralls is recommended. Use good industrial hygiene and housekeeping practices. Keep away from open flames, hot surfaces and sources of ignition.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, spark and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials; combustibles, and sources of heat. Keep away from incompatibles. Ideal storage temperature is 10-27°C (50-80°F). Do not expose sealed containers to temperatures above 40°C (104°F).

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sodium Nitrate	10 mg/cu m (nuisance dust)	NA	
Mineral Oil	5 mg/m³	5 mg/ m³	

Other exposure guidelines: Ammonium Nitrate: ORICA Guideline 5 mg/m^3 (internal TWA)

Engineering Measures: No information available.

Personal Protective Equipment

Eye/Face Protection: Tightly fitting safety goggles.

Skin Protection: User should verify impermeability under normal conditions of use prior to general use. Impervious butyl rubber gloves.

Respiratory Protection: In case of insufficient ventilation wear suitable respiratory equipment. A NIOSH-approved respirator, if required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice. Recommendations listed in this section indicate the type of equipment, which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Orange, viscous putty-like	**Odor:**	Odorless
Physical State:	Putty-like	**Viscosity:**	No information available
pH:	4-6	**Flash Point:**	Not applicable
Autoignition Temperature:	230-265°C/ 446-509°F	**Boiling Point/Range:**	None
Melting Point/Range:	Not available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	1.09-1.33 g/cc	**Water Solubility:**	Negligible
Other Solubility:	No information available	**Vapor Pressure:**	0 mmHg @ 20°C
Oxidizing Properties:	Oxidizer	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Decomposition Temperature: Ammonium Nitrate will spontaneously decompose at 210°C (410°F).

Conditions to avoid: Keep away from open flames, hot surfaces and sources of ignition. Not expected to be sensitive to static discharge. Not expected to be sensitive to mechanical impact.

Incompatible materials: Avoid oxidizable materials, metal powder, bronze & copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorate, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles. Strong oxidizing and reducing agents.

Hazardous decomposition products: The following toxic decomposition products may be released. At temperatures above 210°C, decomposition may be explosive, especially if confined. Nitrogen oxides (NOx). Carbon oxide. Hydrocarbons.

Hazardous Polymerization: None under normal processing. Hazardous polymerization does not occur. Explosive material under shock conditions.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ammonium Nitrate	2217 mg/kg Rat	3000 mg/kg Rabbit	88.8 mg/L Rat 4 h
Sodium Nitrate	1267-4300 mg/kg Rat		
Mineral Oil	4300 mg/kg Rat		

Subchronic Toxicity (28 Days): Sodium Nitrate; Ammonium Nitrate: Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy lips, tongue and mucous membranes, with skin color being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly shock.

Chronic Toxicity: May cause methemoglobinemia.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).

Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.

Reproductive effects: No information is available and no adverse reproductive effects are anticipated.

Developmental effects: No information is available and no adverse developmental effects are anticipated.

Target Organ: Eyes, skin, respiratory system, blood, liver urinary tract, & gastrointestinal tract (GI).

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Chemical Name	Freshwater Algae Data	Freshwater Fish Species Data	Microtox Data	Water Flea Data	log Pow
Sodium Nitrate					-3.8

Persistence/Degradability: Some water resistance but soluble with extended time periods.
Mobility in Environmental media: Dissolves slowly in water

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name: Explosive, blasting type E
Hazard Class: 1.1D
UN-No: UN0241
Packing group: II
TDG Proper Shipping Name: Explosive, blasting type E
Hazard Class: 1.1D
UN-No: UN0241
Packing group: II

Transportation Emergency Telephone Number: 1-877-561-3636 or CHEMTREC: 1-800-424-9300

SECTION 15 – REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.
USA CLASSIFICATION:
SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements, Ammonium Nitrate (6484-52-2), Sodium Nitrate (7631-99-4) & Mineral Oil (64742-53-6).
SARA 311/312 Hazardous Categorization
Acute Heath Hazard: Yes
Chronic Health Hazard: Yes
Fire Hazard: No
Reactive Hazard: Yes
Sudden Release of Pressure Hazard: Yes
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents
Other Regulations/Legislations which apply to this product: New Jersey Right-to-Know, Pennsylvania Right-to-Know, Massachusetts Right-to-Know, Rhode Island Right-to-Know, Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, California Proposition 65.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

The components in the product are on the following international inventory lists:

Chemical Name	TSCA	DSL	NDSL	ENCS	EINECS	ELINCS	CHINA	KECL	PICCS	AICS
Ammonium Nitrate	X	X	-	X	X	-	X	X	X	X
Sodium Nitrate	X	X	-	X	X	X	X	X	X	X
Mineral Oil	X	X	-	-	X	-	X	X	X	X

Legend: X – Listed

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 24-Aug-2007
Revision Date: 18-Jul-2008

The information contained herein is offered only as guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Figure 37. Magnafrac Data Sheet