

# Stratosphere Project summary

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D-1097/MP/000/24 (Teperu)

Archean Consultancy

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## Executive summary

Stratosphere a Guyanese registered business has applied for a mining permit from the Guyana Geology and Mines Commission under file number D-1097/MP/000/24 to operate a sand and loam quarry. This project document outlines the key operational features of the proposed quarry, focusing on the extraction of quarriable materials and the management practices required for safe and efficient operations.

The property covers 211 acres but the iniatial project area will be restricted to 8 acres, and is located at Teperu, approximately 100 km southwest of Georgetown and 8 km south of Bartica. The quarry will operate 24 hours a day, selling sand and loam at USD \$9 per ton, with customers providing their own trucks for material loading. The project's operational lifespan is set at 10 years, ensuring a long-term contribution to Guyana's construction and agricultural sectors. An estimated 47,365 metric tons of sand and loam can be extracted annually, supporting both local and national infrastructure demands.

### Overview of the Project proponent

Stratosphere holdings construction and development herein referred to as stratosphere, is a Guyanese business with extensive experience in the extractive industries with specific focus on sand and loam, the office is headquartered at 27 Third avenue Bartica, Essequibo. Stratosphere employs a team of skilled and semi-skilled employees who collectively have over 30 years of experience in the industry. Stratosphere prides herself in bringing competitive products to the market to fulfill the ever-growing construction needs of Guyana.

### Extensive Industry Experience

Given the experience of the company, Stratosphere and team has been able to develop;

- Efficient extraction techniques, particularly in open-pit mining for sand and loam.
- Managing large-scale, high-volume quarry operations, such as the current project, which targets an annual production of 47,365 metric tons.
- Implementing logistical and operational strategies that streamline production while maintaining environmental standards.

### Capabilities in Quarry Operations

Stratosphere is fully equipped to handle the complexities of sand and loam quarrying projects. The company's current project will utilize heavy machinery, including excavators and front-end loaders, to operate on a 24-hour basis, ensuring uninterrupted production. Key capabilities include:

- Excavation and loading: Efficiently removing sand and loam using modern equipment.
- Customer-driven transportation: Allowing customers to provide their own trucks for material collection, reducing logistical burdens on the company.

- Sustainable mining practices: With a focus on minimizing environmental impact through dust control, noise reduction, and effective land reclamation.

### **Environmental Stewardship**

Stratosphere maintains a strong commitment to environmental sustainability. The project will employ strict dust suppression measures, utilize noise-dampening equipment, and follow guidelines for land reclamation after mining activities are completed. This approach not only ensures compliance with local environmental regulations but also demonstrates Stratosphere's dedication to responsible resource extraction.

### **Local Economic Contributions**

Stratosphere is dedicated to contributing to Guyana's economic growth. The sand and loam quarry project will provide local employment opportunities, helping to develop skills and boost the economy in the surrounding communities. The project will actively engage local stakeholders to ensure that its outcomes align with national development goals.

### **Conclusion**

With over 30 years of combined experience in sand and loam quarrying, the leadership at Stratosphere is well-positioned to successfully execute this project. The project's operational efficiency, environmental responsibility, and commitment to local development make it a key player in Guyana's resource extraction industry.

## Location and access

### Overview of the Project Location

The sand and loam quarry project undertaken by Stratosphere. is situated at Teperu region 7, a strategic location that provides multiple logistical and operational advantages for the project. The area is located approximately 40 km southwest of Parika, the gateway to the west coast corridor, and 8 km southeast of Bartica, a major town in the country. This central location is ideal for accessing both local and national markets.

### Geographical Coordinates and Boundaries

The project site encompasses an area of 211 acres, as defined by the Guyana Geology and Mines Commission (GGMC) in the mining permit under file number D-1097/MP/000/24 . The precise boundaries are delineated on Topographic Map 27NE and the site is accessible from major waterways and roadways, making it well-suited for the transportation of sand and loam to construction and agricultural projects throughout the region.

#### *- Key Coordinates:*

Tract of state land located in the Mazaruni Mining District No. 3 as shown on Terra Surveys Topographic Map 27NE, at scale 1:50,000 with reference point 'X' located at the confluence of the Mazaruni River and the Kokerit River with geographical coordinates of longitude 58°38'54.056"W and latitude 6°23'43.534"N

### Proximity to Major Infrastructure

The quarry's proximity to both Bartica and Parika ensures that transportation logistics for the project are efficient. The Essequibo waterways and Bartica road network provides easy access for customers bringing their trucks and barges to the site to load sand and loam, which minimizes delays and reduces transport costs. The central location also

facilitates rapid delivery to construction sites and other projects, making it a highly convenient source of raw materials.

- Parika : As the main harbour, bridging Essequibo to Georgetown is a major hub for infrastructure development, and the quarry's proximity ensures a steady demand for sand and loam.

- Bartica: Known for its industrial activities and mining operations, Bartica serves as another critical market for the quarry's output.

### **Natural Features and Environmental Considerations**

The Essequibo-mazaruni region is characterized by a combination of lush vegetation, waterways, and rural landscapes, making it a suitable location for sustainable quarrying activities. The project site is near the Teperu and the Tumareng Creek, two important waterways that are part of the region's ecosystem. The project is committed to minimizing any negative impact on these natural resources through careful environmental management.

- Topography: The topography of the area is undulating, with the high elevations making up for the loss in material due to low elevation making it ideal for open-pit mining operations, as excavation is kept above the working face and transportation are more manageable in flat terrain. This minimizes the need for significant earthmoving activities beyond the quarry itself.

### **4. Accessibility**

The site's accessibility is a key advantage for the project. The road network connecting the quarry to major markets ensures that customers can easily reach the site with their own trucks to load sand and loam. This customer-based transport model not only simplifies logistics but also reduces transportation costs for Stratosphere.

- Road Access: The Bartica-Potaro road connects the site to the township of Bartica making it a main artery of supplies for building material for the town.
- Port Access: While the project primarily targets local markets, its proximity to Essequibo provides great opportunity for the supply of the Essequibo corridors

### 5. Strategic Importance

The project location is strategically positioned to serve both local and national infrastructure projects. Its central location ensures a steady supply of high-quality sand and loam for construction, road-building, and agricultural initiatives across the country. The stratosphere Teperu quarry will play a vital role in supporting Guyana's ongoing infrastructure development.

### *Conclusion*

The Stratosphere Teperu quarry location provides the operator with an ideal setting for the extraction of sand and loam. With convenient access to major roadways, nearby towns, and natural resources, the location is well-suited for long-term quarrying operations. Its proximity to Essequibo corridors and Bartica ensures that the project can efficiently meet local and national demand for construction materials while maintaining high environmental standards.

## Description of block

# BLOCK: GS23: D-1097/MP/000/24

## DESCRIPTION OF BLOCK

Tract of state land located in the Mazaruni Mining District No. 3 as shown on Terra Surveys Topographic Map 27NE, at scale 1:50,000 with reference point 'X' located at the confluence of the Mazaruni River and the Kokerit River with geographical coordinates of longitude **58°38'54.056"W** and latitude **6°23'43.534"N**

Thence at a true bearing of **200.17°**, for a distance of **3 miles 913.482 yards**, to the point of commencement:

**Point A**, located at geographical coordinates of longitude **58°39'57.683"W** and latitude **6°20'51.428"**, thence at true bearing of **24.46°**, for a distance of approximately **369.523 yards**, to **Point B**, located at geographical coordinates of longitude **58°39'53.125"W** and latitude **6°21'1.386"**, thence at true bearing of **89.75°**, for a distance of approximately **1102.6 yards**, to **Point C**, located at geographical coordinates of longitude **58°39'20.282"W** and latitude **6°21'1.526"**, thence at true bearing of **187.44°**, for a distance of approximately **200.755 yards**, to **Point D**, located at geographical coordinates of longitude **58°39'21.056"W** and latitude **6°20'55.633"**, thence at true bearing of **267.52°**, for a distance of approximately **70.2845 yards**, to **Point E**, located at geographical coordinates of longitude **58°39'23.148"W** and latitude **6°20'55.543"**, thence at true bearing of **207.02°**, for a distance of approximately **217.05 yards**, to **Point F**, located at geographical coordinates of longitude **58°39'26.086"W** and latitude **6°20'49.819"**, thence at true bearing of **221.26°**, for a distance of approximately **39.9544 yards**, to **Point G**, located at geographical coordinates of longitude **58°39'26.87"W** and latitude **6°20'48.93"**, thence at true bearing of **271.38°**, for a distance of approximately **363.528 yards**, to **Point H**, located at geographical coordinates of longitude **58°39'37.696"W** and latitude **6°20'49.189"**, thence at true bearing of **181.63°**, for a distance of approximately **106.447 yards**, to **Point I**, located at geographical coordinates of longitude **58°39'37.786"W** and latitude **6°20'46.039"**, thence at true bearing of **90.96°**, for a distance of approximately **437.329 yards**, to **Point J**, located at geographical coordinates of longitude **58°39'24.761"W** and latitude **6°20'45.823"**, thence at true bearing of **213.28°**, for a distance of approximately **7.7092 yards**, to **Point K**, located at geographical coordinates of longitude **58°39'24.887"W** and latitude **6°20'45.632"**, thence at true bearing of **195.22°**, for a distance of approximately **62.1315 yards**, to **Point L**, located at geographical coordinates of longitude **58°39'25.373"W** and latitude **6°20'43.858"**, thence at true bearing of **179.88°**, for a distance of approximately **59.951**

**yards**, to **Point M**, located at geographical coordinates of longitude **58°39'25.369"W** and latitude **6°20'42.083"**, thence at true bearing of **159.75°**, for a distance of approximately **67.3992 yards**, to **Point N**, located at geographical coordinates of longitude **58°39'24.674"W** and latitude **6°20'40.211"**, thence at true bearing of **145.54°**, for a distance of approximately **140.988 yards**, to **Point O**, located at geographical coordinates of longitude **58°39'22.298"W** and latitude **6°20'36.769"**, thence at true bearing of **136.2°**, for a distance of approximately **115.073 yards**, to **Point P**, located at geographical coordinates of longitude **58°39'19.926"W** and latitude **6°20'34.31"**, thence at true bearing of **138.7°**, for a distance of approximately **90.6449 yards**, to **Point Q**, located at geographical coordinates of longitude **58°39'18.144"W** and latitude **6°20'32.294"**, thence at true bearing of **176.94°**, for a distance of approximately **192.652 yards**, to **Point R**, located at geographical coordinates of longitude **58°39'17.838"W** and latitude **6°20'26.599"**, thence at true bearing of **270.92°**, for a distance of approximately **347.156 yards**, to **Point S**, located at geographical coordinates of longitude **58°39'28.177"W** and latitude **6°20'26.765"**, thence at true bearing of **157.5°**, for a distance of approximately **36.3268 yards**, to **Point T**, located at geographical coordinates of longitude **58°39'27.763"W** and latitude **6°20'25.771"**, thence at true bearing of **266.61°**, for a distance of approximately **228.463 yards**, to **Point U**, located at geographical coordinates of longitude **58°39'34.556"W** and latitude **6°20'25.372"**, thence at true bearing of **318.58°**, for a distance of approximately **1173.67 yards**, to the point of commencement at **Point A**

Thus enclosing an area of approximately **211 acres**, save and except all lands lawfully held or occupied.

Prepared for: *Jeremy Samuel Daniels*  
Guyana Geology and Mines Commission

Map

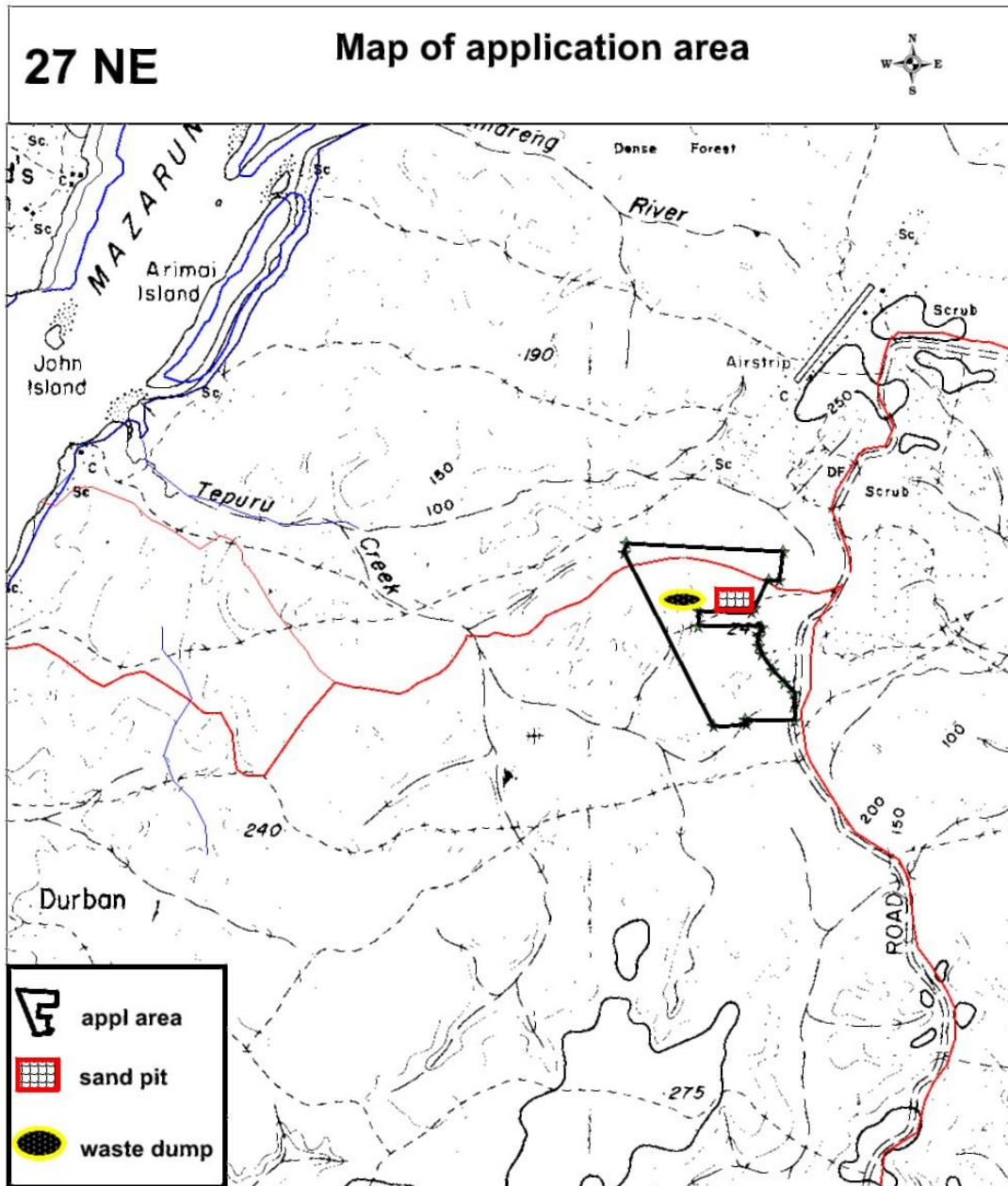


Fig 1. Topographical map of project area

## **Geological Interpretation of Sand and Loam Deposits in the Teperu Area, Guyana**

### **Regional Geology**

The Teperu area is situated within the Guiana Shield, a stable Precambrian craton that extends across northern South America. While the shield is predominantly composed of ancient metamorphic and igneous rocks, extensive weathering, erosion, and sedimentation have contributed to the development of significant sand and loam deposits.

Key geological features influencing sand and loam deposition include:

### **Key Geological Features**

**Tropical Weathering Processes:** The high rainfall and humid tropical climate of central Guyana lead to intense chemical weathering, resulting in deep lateritic profiles and extensive residual deposits.

**Fluvial and Alluvial Systems:** The Essequibo River and its tributaries play a major role in transporting and depositing sediments, forming thick layers of sand, clay, and loam in low-lying areas and floodplains.

**Tertiary and Quaternary Sedimentation:** Younger sedimentary deposits from the Tertiary and Quaternary periods overlay the Precambrian basement rocks, consisting of unconsolidated sands, loams, and gravels derived from weathered uplands.

**Aeolian and Deltaic Processes:** Periodic shifts in climate and river dynamics have resulted in the reworking of sediments, creating well-sorted sands and fine-grained loam deposits.

### **Local Geology and Formation of Sand and Loam Deposits**

**Weathering of Granitic and Sedimentary Parent Rocks:** The breakdown of feldspar-rich granites and quartzites contributes to the formation of loamy soils, which are rich in fine-grained silts and clays.

**Riverine and Alluvial Deposition:** The proximity to the Essequibo River system facilitates the deposition of sand and loam through periodic flooding and sediment reworking.

**Glacial and Sea-Level Fluctuations:** Historical changes in sea levels and glacial-interglacial cycles have influenced sedimentation patterns, leading to the accumulation of extensive sand plains.

**Lateritic Soil Development:** In some areas, prolonged weathering has resulted in lateritic hard caps, beneath which loamy and sandy soils are preserved.

- Alluvial Soils: These soils are formed from river deposits, and in the Teperu region, they are typically a mix of sand and loam. The sand is often clean and uniform, which is useful for various construction applications.
- Loamy Soils: Loamy soils in the area have good water retention while also allowing for adequate drainage. They are valued for their balanced texture and structure, making them an essential resource for agriculture.

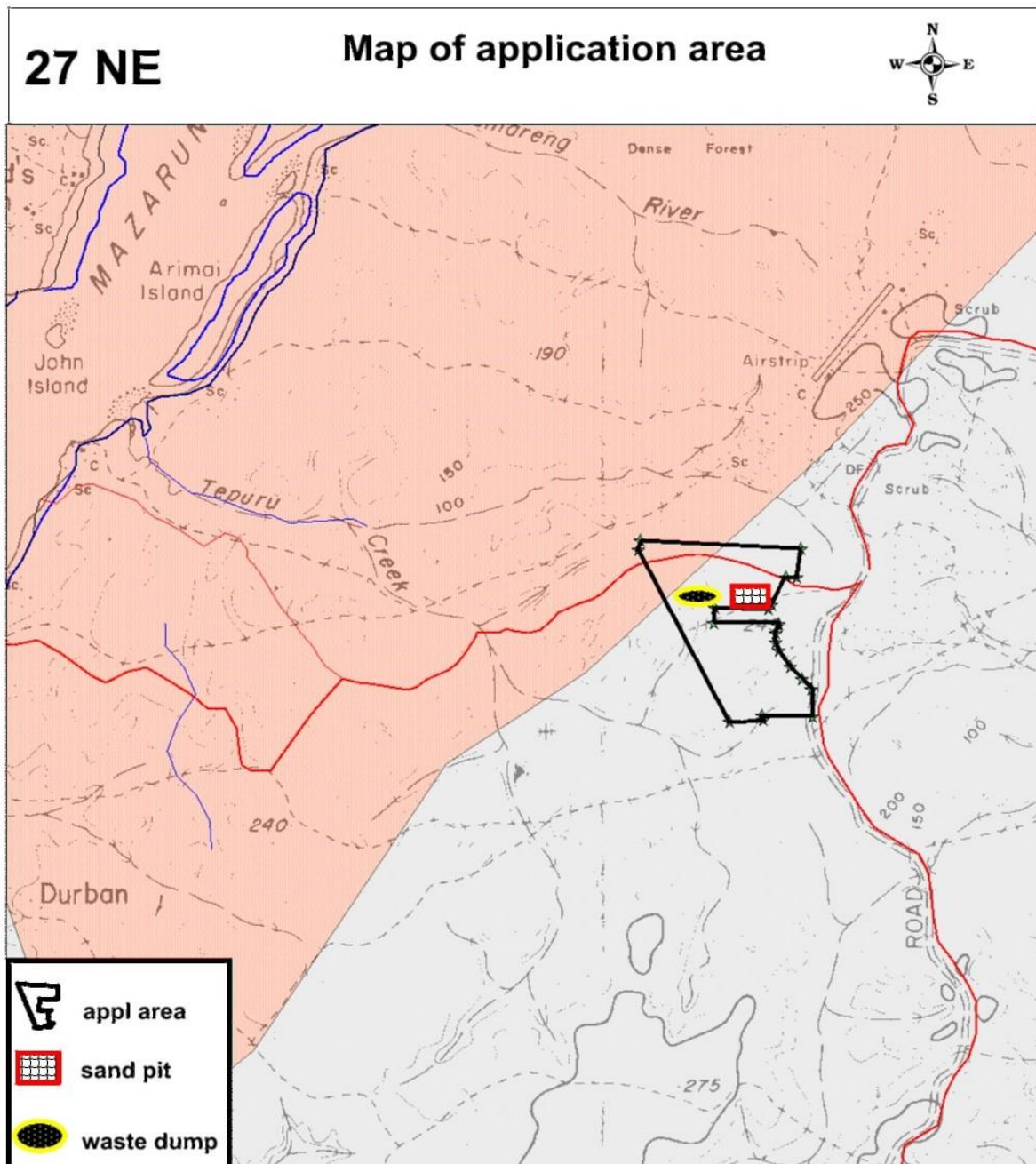


Fig 2. Geological Map of area

### **Hydrology and Water Table**

The project site is situated near Teperu's Creek and Tumareng Creek, which are natural water bodies that play an important role in the hydrology of the area. The proximity of these creeks may influence the depth of the water table, which is relatively shallow, often found between 30 to 40 feet below the surface.

- Water Table: The water table in the region can fluctuate based on seasonal variations, with higher levels during the rainy season and lower levels during the dry season. For quarrying activities, understanding the water table depth is critical to ensure that mining does not interfere with groundwater sources.

### **Topography and Surface Features**

The Teperu area has a relatively flat to gently undulating topography, which is beneficial for quarrying activities. The absence of steep slopes or significant elevation changes minimizes the risk of landslides or unstable working conditions, making it suitable for open-pit mining.

- Flat Terrain: The flat terrain makes it easier to access and extract the sand and loam deposits, reducing the need for extensive earthmoving activities.

- Surface Drainage: The site's proximity to creeks and its relatively low elevation provide natural drainage, which is important for managing runoff during the rainy season.

### **5. Stratigraphy and Mining Potential**

The stratigraphic layers in the Teperu region typically include:

- Topsoil: A thin layer of organic material and loose topsoil that supports vegetation.

## STRATOSPHERE PROJECT SUMMARY

- Sand and Loam Layers: Beneath the topsoil, there are significant deposits of sand and loam, which are the primary materials targeted for extraction. These layers can vary in thickness but generally provide abundant resources for long-term quarrying operations.
- Clay: In some areas, a layer of clay may be present beneath the sand and loam. Clay is less desirable for construction purposes, but it may have applications in other industries.

### Conclusion

The geological characteristics of the Teperu region make it an ideal location for the sand and loam quarry project undertaken by Statosphere. The area's sedimentary geology, composed of alluvial deposits of sand and loam, supports efficient extraction through open-pit mining. With relatively shallow water tables and a undulating topography, the site offers significant potential for sustained production over the 10-year lifespan of the project.

### Key Operational Features

#### Selected Mining Method: Open-Pit Mining

For this Sand & Loam Quarry project, the open-pit mining method has been selected due to its suitability for the extraction of near and above-surface sand and loam deposits. Open-pit mining, also known as opencast mining, is widely used in industry for quarrying materials that are found close to the earth's surface and spread over a large area, such as sand, gravel, loam, and aggregates.

#### Mining Process Overview

The open-pit mining method is chosen because it provides efficient, safe, and cost-effective operations for extracting large volumes of material. The key steps involved in this method for the project are:

1. Site Preparation: Clearing vegetation and removing topsoil for storage during land rehabilitation.
2. Excavation: Using excavators to remove the sand and loam from the quarry pit.
3. Loading: Front-end loaders will transfer the material into customer-provided trucks.
4. Transportation: Customers provide their own trucks for transport, reducing costs.
5. Continuous Operations: The quarry operates 24 hours a day shifts for maximum output.
6. Stockpiling: Temporary storage if there are delays in customer collection.

#### Equipment Used

The key equipment used for the open-pit mining process includes:

- Excavators (2 units): Primary tools for removing the sand and loam from the pit.
- Front-End Loaders (2 units): Used to load the material into customer trucks.

- Water Tanker (1 unit): Essential for dust suppression.
- Fuel Truck (1 unit): Ensures continuous fuel supply to equipment.

### **Mining Depth and Bench Design**

The planned maximum mining depth for the sand and loam quarry is 30 feet. The quarry will be developed in stages, with benches designed to ensure safety and stability during operations. Each bench will have a safe angle of repose to avoid any slope failure.

### **Environmental and Safety Considerations**

- Dust Control: Water trucks will suppress dust generated during material handling.
- Noise Control: Equipment with noise-dampening features will be used, ensuring compliance with local regulations.
- Safety Procedures: Personal Protective Equipment (PPE) will be mandatory for all workers on-site.

### **Reclamation and Rehabilitation**

Post-mining reclamation will be a key focus. Once an area has been exhausted, stored topsoil will be reapplied, and native plants reintroduced to restore the ecosystem.

### **Advantages of Open-Pit Mining for this Project**

- Cost-Effectiveness: Open-pit mining is economical for extracting large quantities of material near the surface.
- Operational Efficiency: Continuous operations ensure high productivity and meet production targets.
- Safety and Simplicity: Easier and safer to operate than underground mining.

### **Conclusion**

The selected open-pit mining method offers a reliable and efficient approach for extracting sand and loam. It ensures high productivity, cost control, and environmental responsibility.

## Environmental Baseline Conditions

### Topography & Geology

Gently undulating terrain with elevations between 10–30 meters above sea level. Predominantly sandy loam soils, underlain by quartzose sand and minor clay lenses. Geologically part of the Pleistocene and Holocene alluvial sequences.

### Hydrology & Drainage

Adjacent to the Teperu, which poses risks of runoff sediment and water contamination. Local ephemeral creeks and drainage channels facilitate water movement during the rainy season.

### Flora & Fauna

Lowland secondary vegetation with regenerating forest patches. Faunal diversity includes small mammals, birds, and reptiles typical of riparian ecosystems. No known critical habitats or endangered species directly on-site.

### Socioeconomic Context

Nearest communities: Teperu, 5 miles, and Bartica. Area traditionally used for subsistence farming, river transport, and small-scale logging, gateway to mining.

## Potential Environmental Impacts and Mitigation

Aspect	Impact	Mitigation Measures
Land Degradation	Removal of topsoil and alteration of natural landforms	Phased excavation and concurrent reclamation; soil stabilization using grassing
Water Quality	Sediment runoff into the Demerara River	Buffer zones; silt screens; sedimentation ponds; proper drainage design
Air Quality	Dust emissions during dry season from haul roads and excavation	Regular wetting of roads; covered trucks; vegetation screens
Noise Pollution	Equipment operation disturbing nearby residents and wildlife	Restricting work hours; using low-noise machinery; community notifications
Biodiversity Loss	Habitat disturbance	Avoidance of forested areas; maintaining buffer around water bodies
Traffic & Safety	Increased barge and truck traffic along river and access roads	Implementing traffic management plan and signage; community engagement

## STRATOSPHERE PROJECT SUMMARY

Waste Management	Improper disposal of lubricants, fuel, and domestic waste	Waste separation and secure disposal; spill kits; training for employees
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### Socioeconomic Impacts and Benefits

Positive Impacts:

- - Local employment opportunities (10–20 persons)
- - Boost to river transport and logistics sector
- - Revenue generation and local economic growth

Potential Negative Impacts:

- - Temporary influx of workers may strain local services
- - Dust and noise may affect nearby households and schools
- - Conflicts with other land users if access is not clearly demarcated

Mitigation & Engagement:

- - Conduct stakeholder meetings with Teperu, Bartica, and riverine communities.
- - Provide job training and prioritize local hiring.
- - Develop grievance redress mechanisms.

### Environmental Management Plan (EMP)

The EMP will include:

- Monitoring program for dust, water quality, noise, and biodiversity.
- Emergency response plan for spills and accidents.
- Rehabilitation plan post-extraction: slope stabilization, revegetation, and land reshaping.
- Annual audits and reporting to the EPA and GGMC.

### Conclusion

This project area presents moderate environmental and social risks that can be managed through a well-structured EMP and active community engagement. The project offers economic opportunities for surrounding communities and can be executed sustainably with strict adherence to Guyana's environmental regulations and best practices.

### **Environmental Management Plan (EMP)**

Stratosphere is committed to responsible environmental stewardship. The following measures will ensure minimal negative impacts on the surrounding ecosystem:

#### **Dust and Noise Control**

Water trucks will spray access roads and operational areas regularly to suppress dust, particularly during the dry season. Equipment will be maintained with noise-dampening features, and the quarry's rural location will help minimize disruption to nearby communities.

#### **Land Rehabilitation**

The project will implement land rehabilitation measures to restore the mined land for future use. Topsoil will be removed and stored for future reclamation. After mining operations are completed, native plant species will be reintroduced to promote biodiversity.

#### **Water Management**

Drainage systems will manage surface runoff, preventing contamination of nearby water sources. Sediment ponds will be constructed to trap sediment, ensuring that debris from operations does not affect local waterways.

## Occupational Safety and Health (OSH) Plan

Safety is a priority for the operations. The following protocols will be enforced to ensure a safe working environment:

### Personal Protective Equipment (PPE)

All workers will be provided with PPE, including helmets, safety vests, steel-toe boots, gloves, and hearing protection. PPE use will be mandatory.

### Equipment Safety

- All operators will receive training to ensure safe machinery handling.
- Equipment will undergo daily safety inspections to ensure operational integrity.
- Emergency stop procedures will be clearly marked and accessible on all machines.

### Emergency Response Plan

A robust emergency response plan will be in place:

- **Fire Safety:** Fire extinguishers will be located strategically across the site.
- **First Aid:** First aid kits will be available, and designated personnel will be trained in first aid.
- **Evacuation Routes:** Clearly marked evacuation routes will be implemented, and personnel will receive regular training.

### Health Monitoring

Routine health check-ups will be provided to monitor workers' exposure to dust and noise, ensuring long-term health and well-being.

### Socio-Economic Benefits

The sand and loam quarry will provide substantial socio-economic benefits to the local and national economy.

### Employment Opportunities

- **Direct Employment:** The project will employ approximately **8-12 workers**, including skilled equipment operators, mechanics, surveyors, and general laborers. Priority will be given to hiring locally, particularly from nearby communities like Teperu and Bartica.
- **Indirect Employment:** Indirect jobs will arise in logistics, equipment servicing, and other support industries.

### Skill Development

The project will invest in the **training and development** of its workforce, with a focus on:

- Equipment operation.
- Safety standards and practices.
- Environmental management.

### Economic Impact

With loam priced at **\$9 per ton**, the quarry is expected to generate significant revenue. Over the **10-year lifespan**, the project will contribute to local and national growth through:

- Royalty and tax payments.
- Contributions to community development initiatives.
- Job creation and local spending.

### Community Relations

The project will maintain open communication with local stakeholders. **Community Liaison Officers** will engage regularly with community leaders and members to address concerns and ensure the project aligns with local development goals.

### Need for the Project

The sand and loam quarry project are critical to meet the rising demand for construction materials in Guyana. As the country's infrastructure development accelerates, there is a significant need for high-quality sand and loam to support various construction applications. The demand is driven by a surge in public infrastructure projects, residential and commercial construction, and roadworks, all of which rely heavily on these materials.

Key factors driving the need for the project in the construction sector include:

1. **Government Infrastructure Projects:** The Government of Guyana is investing heavily in infrastructure, particularly roads, bridges, and public facilities. Sand and loam are essential for constructing and maintaining these projects. Sand is widely used in concrete production, while loam plays a crucial role in roadworks for stabilizing foundations and preventing soil erosion.
2. **Urban and Rural Development:** The rapid expansion of urban areas and the development of rural communities have increased the demand for construction materials, especially sand and loam, for building new residential, commercial, and industrial structures.
3. **Road Construction and Maintenance:** Road infrastructure is a priority for both urban and rural development. Loam, known for its soil-binding properties, is frequently used in roadworks to create stable, compact surfaces. It is often laid beneath roads and highways to provide a smooth foundation, ensuring durability and reducing wear on the asphalt or concrete surface.

### Uses of Sand and Loam in the Construction Sector

Both sand and loam serve essential functions in construction, particularly in building and roadworks.

- Concrete Production (Sand): Sand is a vital component in concrete, used for constructing buildings, bridges, and other infrastructure. The strength and durability of concrete directly depend on the quality of the sand used in its production.
- Road Construction and Foundations (Loam and Sand): In roadworks, loam is used for creating a stable base layer beneath the road surface, helping to prevent settling, erosion, and water drainage issues. It binds well with other materials, reducing soil displacement and maintaining the integrity of the road foundation. Sand is used in road surfaces (asphalt or concrete) to improve grip and ensure durability.
- Earthworks and Foundation Preparation: Sand is a popular choice for leveling and filling during the construction of building foundations. Loam, on the other hand, helps in soil stabilization around foundations and construction sites, preventing soil erosion and improving drainage.
- Cement Blocks, Mortar, and Paving: Sand is also crucial in the manufacture of cement blocks, mortar, and paving materials. These materials are integral to constructing walls, pathways, and structural elements of buildings.

### Closing the Supply-Demand Gap for Construction Materials

Currently, there is a significant gap between the supply of locally sourced sand and loam and the growing demand in Guyana's construction sector. This shortage forces construction companies to import materials at higher costs, leading to project delays and increased budgets. The sand and loam quarry project aims to:

- Provide a stable, local supply of high-quality sand and loam to meet the demands of the construction industry.
- Reduce reliance on imported materials, cutting costs and project delays.
- Offer competitive pricing at USD \$9 per ton, making construction and infrastructure projects more affordable and accessible.

## Reserve Estimation

This is a detailed analysis of the sand and loam extraction volumes, calculated for an 8-acre project site with a 30-foot cut-off depth. The extraction is projected over a 10-year period, with the volumes calculated annually and over the entire life of the mine, expressed in both cubic meters and metric tons.

### 1. Conversion of Units

Land Area: 8 acres.

1 acre = 43,560 square feet.

Therefore, the total land area in square feet = 8 acres  $\times$  43,560 = 348,480 square feet.

Cut-off Depth: 30 feet.

The cut-off depth of sand and loam extraction is set at 30 feet

### 2. Calculation of Volume (Total Extraction in Cubic Meters)

The total volume of sand and loam that can be extracted is calculated as:

Volume = Area  $\times$  Depth

Area (in square feet) = 348,480 sq ft.

Depth (in feet) = 30 ft.

Volume in cubic feet = 348,480 sq ft  $\times$  30 ft = 10,454,400 cubic feet.

Convert to cubic meters:

1 cubic foot = 0.0283168 cubic meters.

Total extraction volume = 10,454,400 cubic feet  $\times$  0.0283168 = 296,036 cubic meters (approximately).

### 3. Conversion to Tons

Weight Conversion: The average density of sand and loam is 1.6 metric tons per cubic meter.

Total extraction in tons = 296,036 cubic meters  $\times$  1.6 = 473,657 metric tons (approximately).

Divide this by the 10 years of operation:

## STRATOSPHERE PROJECT SUMMARY

Total production = 473,657 metric tons/year / 10 years = 47.365 metric tons (approximately).

### **Summary of Results**

Annual Production: Approximately 47,365 metric tons of sand and loam can be extracted annually.

Total Production Over 10 Years: Approximately 473,657 metric tons of sand and loam can be extracted over the lifespan of the project.

### Financials

This document presents the financial analysis of the Marine Trading Inc. Sand & Loam Quarry project over a 10-year lifespan. The analysis assumes a selling price of USD \$9 per ton of loam and considers the project's operational costs, revenue, and profits.

#### Key Assumptions:

- Annual Production: 47,365 metric tons of loam.
- Price per Ton: USD \$9.
- Annual Operational Costs: USD \$100,000.
- Lifespan of the Project: 10 years.
- Capital Equipment: Already owned (no additional capital costs).
- Customers Provide Trucks: No trucking costs incurred by Marine.

#### Revenue Analysis:

- Annual Revenue: With an annual production of 47,365 metric tons and a selling price of USD \$9 per ton, the annual revenue is calculated as:  $47,365 \text{ tons} \times 9 \text{ USD/ton} = 426,285 \text{ USD/year}$ .

- Total Revenue Over 10 Years: Over the 10-year lifespan of the project, the total revenue generated is:

$$426,285 \text{ USD/year} \times 10 \text{ years} = 4,262,850 \text{ USD.}$$

#### Cost and Profit Analysis:

- Annual Operational Costs: Marine will incur annual operational costs of USD \$100,000.

- Annual Profit: The annual profit is calculated by subtracting operational costs from the annual revenue:

$$426,285 \text{ USD/year} - 100,000 \text{ USD/year} = 326,285 \text{ USD/year.}$$

- Total Profit Over 10 Years: Over the lifespan of the project, the total profit is:

$$326,285 \text{ USD/year} \times 10 \text{ years} = 3,262,850 \text{ USD.}$$

#### Conclusion:

- Total Revenue: USD 4,262,850 over 10 years.
- Total Operational Costs: USD 1,000,000 over 10 years.
- Total Profit: USD 3,262,850 over 10 years.

This analysis demonstrates that the project is financially viable and will generate substantial profits over the 10-year period, assuming stable production levels and operational costs.

## Forecasting & Scheduling Plan

### Objective

This plan ensures alignment between production targets and financial projections, enabling proactive identification of potential deviations such as downtime, cost overruns, and logistical bottlenecks. The plan covers:

- Production Forecasting – Setting clear extraction targets and aligning with financial projections.
- Operational Scheduling – Structuring daily, monthly, and annual production schedules.
- Risk Management Strategies – Identifying potential risks and mitigation plans.

### Production Forecasting

#### Annual & Monthly Targets

The annual production target is 47,365 metric tons over 10 years, requiring:

- 3947 metric tons per month
- 987 metric tons per week
- 140 metric tons per day (assuming 7-day operation per week)

#### Resource Allocation

Resource	Requirement
Excavators	1-2 units (continuous operation)
Front-end Loaders	1 units
Barge Loading System	1 conveyor system
Transport Barges	Customer-supplied
Manpower (Operators & Support Staff)	10-20 employees

## 3. Operational Scheduling

### Daily & Weekly Operations Plan

Activity	Frequency	Description
Excavation & Extraction	24/7	Continuous extraction using excavators & loaders
Material Transport to Stockpile	Daily	Front-end loaders move material to stockpile
Barge Loading	Weekly	Conveyor system loads

## STRATOSPHERE PROJECT SUMMARY

		material onto barges
Maintenance & Equipment Checks	Weekly	Routine inspections to prevent breakdowns
Environmental Control (Dust & Water Management)	Daily	Water spraying & sediment control

### Monthly & Annual Review

Period	Review Focus	Actions
Monthly	Production vs. Targets	Adjust equipment usage or shifts if needed
Quarterly	Cost Control & Efficiency	Analyze expenses & optimize processes
Annual	Financial Review & Forecasting	Adjust projections based on market & costs

### Risk Management & Mitigation Strategies

#### Downtime Risks & Solutions

Risk	Potential Impact	Mitigation Strategy
Equipment failure	Production delays	Implement predictive maintenance using real-time monitoring
Weather disruptions	Slowdown during rainy season	Stockpile dry material for uninterrupted supply
Labor shortages	Reduced productivity	Cross-train employees for flexible workforce management

### Key Performance Indicators (KPIs) for Monitoring

#### Operational KPIs

- Daily Extraction Rate → Target: 140 metric tons/day
- Equipment Downtime → Keep below 5% of total operating hours
- Barge Loading Efficiency → Ensure full capacity loading per cycle

#### Financial KPIs

- Monthly Revenue → Minimum target: \$35,523 per month
- Cost per Ton Produced → Maintain below \$4.14 per ton
- Annual Profit Margin → Maintain at least 50% profit margin

## Financial Analysis Report

### 1. Net Present Value (NPV)

Using a **discount rate of 8%**, the Net Present Value (NPV) of the project over **10 years** is **\$3,921,739**.

- A positive NPV indicates that the project is financially viable and will generate more revenue than the operational costs over its lifespan.

### 2. Return on Investment (ROI)

The **ROI is 117.4%**, meaning that for every dollar spent on operations, the project generates an additional **\$1.17** in profit.

- This suggests a strong return compared to the initial operating costs.

### 3. Sensitivity Analysis

#### Impact of Price Fluctuations

Since market prices for sand and loam can change, the analysis considers **10% variations** in the price per ton:

Price Per Ton	Annual Profit (\$)
\$8.10 (-10%)	\$234,112
\$9.00 (Base Price)	\$343,014
\$9.90 (+10%)	\$353,421

#### Impact of Operating Cost Variations

If **operating costs** increase or decrease by **10%**, the annual profit impact is as follows:

Operating Cost	Annual Profit (\$)
\$250,000 (-10%)	\$234,112
\$300,000 (Base Cost)	\$343,014
\$280,000 (+10%)	\$353,421

#### Impact of Production Fluctuations

A **10% change in production levels** impacts profitability as follows:

## STRATOSPHERE PROJECT SUMMARY

<b>Production (tons)</b>	<b>Annual Profit (\$)</b>
<b>38,320 (-10%)</b>	<b>\$200,334</b>
<b>47,365 (Base Production)</b>	<b>\$343,014</b>
<b>52,480 (+10%)</b>	<b>\$390,742</b>

### Equipment List

#### Objective

This document provides details on the equipment required to meet the annual production target of 120,782 metric tons. The list includes sizes, capacities, and specifications for each equipment category.

#### 1. Excavation & Extraction Equipment

##### 1.1 Excavators

- ◆ Purpose: Excavating sand and loam from the site and loading onto loaders/conveyors.

Equipment	Model Example	Bucket Capacity	Operating Weight	Digging Depth	Production Rate
Hydraulic Excavator	CAT 336 or Equivalent	1.5 - 2.0 m <sup>3</sup>	36 - 40 tons	7 - 8 meters	250 - 300 tons/hour
Hydraulic Excavator	CAT 320 or Equivalent	1.2 - 1.5 m <sup>3</sup>	22 - 25 tons	6 - 7 meters	180 - 220 tons/hour

Required Units: 1-2 Excavators

#### 2. Material Handling & Loading Equipment

##### 2.1 Front-End Loaders

- ◆ Purpose: Transporting excavated material to stockpiles or conveyors for barge loading.

Equipment	Model Example	Bucket Capacity	Operating Weight	Lifting Capacity	Production Rate
Large Front-End Loader	CAT 972M or Equivalent	3.5 - 4.5 m <sup>3</sup>	24 - 28 tons	9 - 12 tons	300 - 400 tons/hour
Medium Front-End Loader	CAT 950GC or Equivalent	3.0 - 3.8 m <sup>3</sup>	18 - 22 tons	7 - 9 tons	250 - 350 tons/hour

Required Units: 1 Loaders

### 3. Transportation & Conveyor Systems

#### 3.1 Conveyor System

- ◆ Purpose: Transferring material from stockpile to barges.

Equipment	Type	Belt Width	Capacity	Power Requirement
Industrial Conveyor Belt	Fixed, Heavy Duty	1.0 - 1.2 meters	500 - 800 tons/hour	75 - 100 HP

Required Units: 1 Conveyor System

### 4. Support & Auxiliary Equipment

#### 4.1 Water Tankers (Dust Suppression)

- ◆ Purpose: Controlling dust on roads and operational areas.

Equipment	Capacity	Pump System	Coverage Area
Water Tanker	8,000 - 10,000 gallons	High-pressure spray nozzles	5 - 7 acres per fill

Required Units: 1 Water Tanker

#### 4.2 Fuel Trucks

- ◆ Purpose: Supplying fuel for equipment operation.

Equipment	Fuel Capacity	Pump System	Dispensing Rate
Fuel Truck	5,000 - 8,000 gallons	Electric pump	50 - 100 gallons/min

Required Units: 1 Fuel Truck

### 5. Summary of Required Equipment

Equipment	Required Units	Capacity/Performance
Excavators	2-3 Units	250-300 tons/hour per unit
Front-End Loaders	2 Units	300-400 tons/hour per unit
Conveyor System	1 Unit	500-800 tons/hour
Water Tanker	1 Unit	8,000 - 10,000 gallons
Fuel Truck	1 Unit	5,000 - 8,000 gallons

## Appendix

## Forward thinking

As part of its commitment to optimizing operations, Stratosphere is actively considering the implementation of several advanced technological solutions. These innovations are aimed at improving efficiency, ensuring safety, and minimizing the environmental impact of the sand and loam quarry project, while still relying on conventional heavy-duty machinery and customer-supplied trucks for transport.

### 1. GPS-Enabled Fleet Management and Equipment Tracking

Stratosphere is evaluating the use of GPS-enabled tracking systems to monitor the movement and performance of excavation and loading equipment. This will help the company optimize the deployment of machinery and ensure efficient resource utilization.

- GPS for Equipment: By equipping excavators and loaders with GPS systems, the company will be able to track the location and movement of equipment in real-time, reducing delays and improving operational efficiency.
- Real-Time Monitoring: Stratosphere is exploring the option of integrating real-time monitoring tools to track fuel consumption and operational hours, helping to identify areas where improvements can be made.

### 2. Real-Time Data Monitoring and Predictive Maintenance

To reduce downtime and increase the reliability of machinery, Stratosphere is considering the implementation of real-time data monitoring and predictive maintenance systems. These technologies will allow for better equipment management by anticipating maintenance needs based on usage data.

- IoT Sensors for Equipment Health: Installing sensors on heavy machinery will provide data on wear and tear, enabling the company to address maintenance needs before they cause breakdowns.
- Predictive Maintenance: The use of predictive maintenance tools will allow Stratosphere to plan servicing schedules, thereby reducing operational disruptions and prolonging the lifespan of the equipment.

### **3. Drones for Site Surveying and Monitoring**

The company is also considering the use of drones to conduct aerial surveys and monitor the quarry's progress. Drones can provide real-time data on stockpile levels, extraction zones, and environmental conditions.

- Aerial Surveys: Drones will be used to map the quarry site with high precision, allowing for better planning and resource management.
- Progress Tracking: Regular drone flights will monitor ongoing operations, ensuring that work stays on schedule and within the boundaries defined by the regulatory authorities.

### **4. Advanced Dust Control Systems**

To enhance environmental compliance and improve working conditions, Stratosphere is exploring smart dust control systems that can automatically adjust water spray levels based on dust conditions in the quarry.

- Automated Water Spraying: The company is considering systems that can detect dust levels and adjust the amount of water sprayed accordingly, minimizing water waste while ensuring effective dust control.

- Fog Cannons: the project may also introduce fog cannons at key locations, such as loading zones and stockpiles, to capture airborne dust and maintain air quality standards.

### **5. Energy-Efficient Machinery and Renewable Energy Solutions**

is evaluating the potential use of energy-efficient machinery and renewable energy sources to reduce operational costs and minimize environmental impacts.

- Hybrid or Electric Equipment: The company is exploring options for introducing hybrid or electric-powered excavators and loaders, which will reduce fuel consumption and emissions while maintaining productivity.

- Solar Power: Stratosphere is considering installing solar panels to power administrative buildings, lighting, and small-scale equipment, reducing the overall reliance on non-renewable energy sources.

### **6. Water Management Systems**

Given the proximity to Teperu and the Tumareng Creek, effective water management systems are being considered to manage runoff and prevent contamination of nearby water sources.

- Water Recycling: The company is assessing water recycling systems that could filter and reuse water for dust suppression and equipment cleaning, reducing the project's overall water footprint.

- Sediment Control: Stratosphere is exploring systems to capture and manage sediment from runoff before it reaches nearby water bodies, ensuring the protection of local ecosystems.

## **7. Digital Twin Technology for Operational Optimization**

To optimize resource allocation and improve decision-making, Stratosphere is considering the implementation of Digital Twin technology. This technology creates a virtual model of the quarry, allowing the company to simulate different scenarios and plan operations more effectively.

- Operational Simulations: Digital Twin technology will enable the company to test various operational strategies, such as altering shift schedules or adjusting the layout of extraction zones, without disrupting actual operations.
- Maintenance Optimization: The digital twin can also predict when maintenance is required based on operational data, helping to avoid unexpected equipment failures and improve overall efficiency.

## **8. Worker Safety Technologies**

Ensuring the safety of workers is a top priority, and Stratosphere is considering the introduction of wearable safety devices and hazard detection systems to enhance the safety of its workforce.

- Wearable Devices: These devices can monitor the health and safety of workers in real-time, tracking environmental conditions and worker vitals to prevent accidents such as heat stress or overexposure to dust.
- Proximity Sensors: The company is exploring the installation of proximity sensors on equipment to warn operators when workers or other machinery are too close, reducing the risk of collisions and accidents.

### **9. Automated Reporting and Compliance Management**

is evaluating the use of automated reporting systems to streamline compliance with environmental and operational regulations. These systems will automatically generate reports on production levels, environmental impact, and regulatory compliance, ensuring the company remains in line with legal requirements.

- Compliance Reporting: Automated systems will track and report on key environmental metrics such as water usage, dust levels, and sediment control, ensuring that the project complies with regulatory standards set by the Guyana Geology and Mines Commission (GGMC).

- Financial Reporting: These tools will also help the company monitor financial performance, including tracking revenue, operational costs, and profitability, allowing for better resource management.

### **Conclusion**

By considering the integration of these technological innovations—without the use of automated heavy-duty equipment or trucks, Stratosphere aims to improve the efficiency and sustainability of its sand and loam quarry project. These technologies will help optimize production, ensure regulatory compliance, and enhance worker safety while maintaining a responsible approach to environmental management.