

## **CHAPTER - 1**

### **INTRODUCTION**

#### **1.1 Background to the Proposed Project**

RS Mines Pvt Ltd., a Sri Lankan Company, had initially obtained an Artisanal Mining License (AML - A) (Annex – 1.1) from the GSMB in 2009 and has renewed the license till 2021 in order to recommence mining activities in the abandoned Queen's mine site at Kotuhena in Maduragoda near Dodangaslanda. Soon after obtaining the mining license, the company had initiated mining activities as per the given guidelines in the mining license, covering the abandoned Queen's mine. So the company had initially begun cleaning the abandoned shafts and adits in Queen's mine complex and continued mining activities up to 25m depth below the surface.

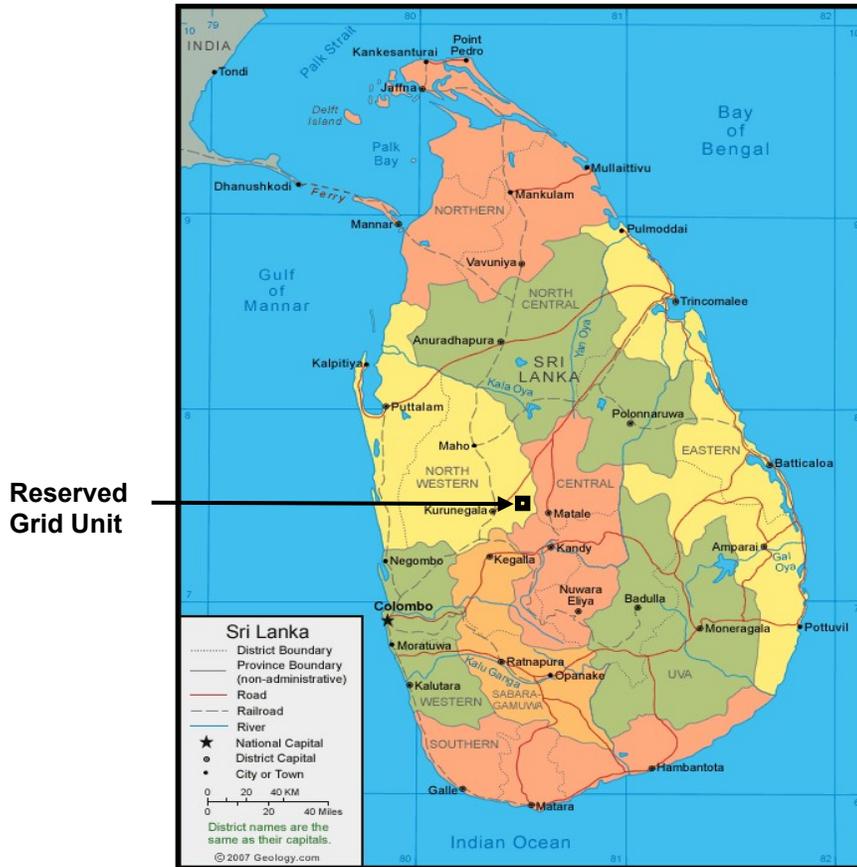
According to villagers who are living around the abandoned Queen's mine complex, mining activities in main Queen's mine at Welanruppa village in Kotuhena GN Division was conducted in early stage of 20<sup>th</sup> century. This currently abandoned mine was located within the Minirankanda ridge structure. Two vertical shafts and three adit structures, which are connected to each other, are present in this abandoned Queen's mine structure and were located on the middle elevation of about 200m high Minirankanda. Mining operations had been abandoned after some time back due to decrease in demands and lack of technology to go further depth.

According to a former worker, about 6 inches to 1.5 feet thick good quality needle type semi-crystalline graphite veins were observed within the Queen's mine at different levels. He further mentioned that considerable amount of economically viable graphite could be mined from the remaining parts of the vein system in this mine, if the mining activities are re-commenced in scientific manner. In addition, substantial amount of graphite could also be mined by extending the mining activities further down in the abandoned surrounding shallow pits.

In order to continue mining activities beyond 25m depth level, it is required to upgrade the mining license to either IML-A or IML-B category.

As an initial step of requirement for obtaining an IML A or B category mining license, the company applied and obtained an Exploration License comprising

single grid unit covered by the Queen's mine (174274 Grid unit) while continuing mining activities under Artisanal Mining License (EL/341) (Fig. 1 and Annex – 1.1A). The exploration license was initially obtained in 2008 for a two year period and later it has been renewed till 2022.



**Fig. 1:** Location Map showing the Reserved Grid Unit

The company's exploration license comprises of one graphite bearing promising grid unit and it contains of considerable number of abandoned graphite mines / pits in Kotuhena area near Maduragoda in Dodangaslanda in Kurunegala District.

Soon after obtaining the exploration license, RS Mines Pvt. Ltd. has conducted a detailed exploration program covering the company's reserved grid unit around Kotuhena area in Maduragoda near Dodangaslanda. It comprised of reconnaissance survey, detailed geological mapping, geophysical investigation, land surveying, rehabilitation of old workings, core drilling, sample analysis and data evaluation. The final exploration report was submitted in September 2019. Later, it was approved by the GSMB.

During the reconnaissance survey, conducted initially under the detailed exploration program, about 13 abandoned open pit shallow shaft structures together with few shallow adit structures were identified within the Minirankanda ridge structure (covering the reserved grid unit). Use of immature tools and technology in earlier days restricted the local mining activities to shallower levels.

As the outcome of the exploration program, economically viable graphitebearing vein systems were found below the 25m depth, covering the abandoned Queen's Graphite Mine Complex. Hence the results are suitable for continuing mining below the 25m depth, covering abandoned Queen's mine complex at Kotuhena near Maduragoda in Dodangaslanda in Kurunegala District.

By considering the prominent nature of graphite mineralization covering the Queen's mine complex at Kotuhena area, based on historical records together with the results of the detailed exploration program conducted by the RS Mines (Pvt) Ltd., the management of RS Mines (Pvt) Ltd. has decided to develop the abandoned Queen's mine complex at Kotuhena area by obtaining IML-A category mining license in order to mine identified remaining graphite bearing vein systems.

The company received the 3<sup>rd</sup> time renewed exploration license on 30.07.2020 and it is valid till 29.07.2022.

## **1.2 Objectives and Justification of the Proposed Project**

### **Objectives of the Proposed Project**

Graphite is one of the main minerals mined and exported by Sri Lanka over the past 150 years. Sri Lanka had been one of the leading suppliers of natural graphite (having extreme purity with over 90% carbon content) to the world market until 1950 and Sri Lanka's approximate share had been 30 – 35% of the total world graphite production.

Graphite mining industry in the country was suddenly collapsed soon after the 2<sup>nd</sup> World War mainly due to the fall of graphite prices as well as owing to the lack of technology and mining professionals to retain the graphite mining industry in the country. However, considerable amount of graphite reserves is expected to remain in situ within these abandoned mines for further exploitation.

World demand of graphite has greatly been increased during last couple of years mainly due to evolution of graphene industry as well as electric vehicles which requires substantial amount of high purity graphite for the production of their batteries. As a result, number of local as well as foreign investors made inquiries about the development of graphite industry in Sri Lanka. Some of the Sri Lankan companies have already established joint ventures with foreign investors from countries like Australia, Canada, England, Germany, etc, and already reserved vast number of grid units with old graphite workings in SW and Central parts of the country in order to carry out exploration activities in order to identify promising areas with graphite mineralization with the intention of opening up of graphite mine/s.

RS Mines Pvt Ltd., a pure Sri Lankan Company, applied and obtained an Exploration License comprising single grid unit covered by the Queen's mine (174274 Grid unit).

Soon after obtaining the exploration license, RS Mines Pvt. Ltd. has conducted a detailed exploration program covering the company's reserved grid unit around Kotuhena area in Maduragoda near Dodangaslanda. It comprised of reconnaissance survey, detailed geological mapping, geophysical investigation, land surveying, rehabilitation of old workings, core drilling, sample analysis and data evaluation. The final exploration report was submitted in September 2019. Later, it was approved by the GSMB.

As the outcome of the exploration program, economically viable graphitebearing vein systems were found below the 25m depth, covering the abandoned Queen's Graphite Mine Complex and the results are suitable for continuing mining below the 25m depth.

RS Mines Pvt Ltd. obtained Artisanal Grade A Mining License for the same grid unit (174274)

In order to obtain an IML-A category mining license to open up graphite mine at the identified area (Queen's Mine at Kotuhena area), it is required to undergo an environmental study for a mining project of this nature. For this purpose, RS Mines (Pvt) Ltd. has contacted Provincial Environmental Authority (PEA) in NW Province in order to discuss the procedure of conducting the environmental study. After having a scoping meeting with relevant government agencies, PEA in NW Province has issued a Terms of Reference (TOR) to the RS Mines (Pvt)

Ltd. to undergo an Initial Environmental Examination (IEE) study prior to issuance of mining license. After obtaining the Environmental Clearance, RS Mines (Pvt) Ltd. could obtain IML-A category mining license from the GSMB.

**- Justification of the Project**

Sri Lanka, in spite of its small size, is reasonably endowed mainly with non-metallic mineral resources. Although lack of technology and expertise has retarded efficient mining and utilization of mineral resources, it is accepted that considerable growth potential exists in the mineral sector. To achieve optimum utilization and maximum benefits of our mineral resources, best applicable scientific technology of mining, beneficiation and economic usage have to be adopted. In view of the present and future development needs of the country, continuous availability of strategic minerals for core industrial production also needs to be assured.

As revealed from mineral investigations performed up to now, Sri Lanka's minerals resource base consist primarily of industrial minerals over other categories. Of these industrial minerals, graphite is considered as one of the prominent minerals identified in the country.

Before the World War II, there had been over 2,500 graphite pits and mines located in the South West and Central Highlands in Sri Lanka. However, currently only two deeper underground mines (Kahatagaha and Bogala mines) and very few shallow mines are in operation.

By exporting upgraded mined graphite, considerable amount of foreign exchange has been earned during last two centuries.

With the initiation of the proposed graphite mining and processing project, there will be maximum value addition to the mined out graphite and with the export of this mineral the foreign exchange reserves of Sri Lanka would be strengthened including Government Policy on minerals extraction and export.

It is envisaged that Sri Lanka will undoubtedly benefit with the establishment of proposed graphite mining and processing project in addition to the benefit gain by the project developers. Encouraging an industry of this nature, which is low polluting, is of special value to the country. Processed graphite has been exported since 18<sup>th</sup> century by the country.

It is expected that the project proponent will use latest techniques and other inputs in connection with the export oriented facility to be established in the Maduragoda area near Dodangaslanda. With the establishment of this project considerable number of direct employments will be generated in and around the Maduragoda area near Dodangaslanda which is one of the less developed regions in the country.

In addition, an equal number of persons indirectly benefitted due to the implementation of the project which will undoubtedly enhance their living standards. It is also realized that large numbers of persons are unemployed around Maduragoda area mainly due to lack of industrial production units.

This venture will also bring in foreign exchange to the country through the exports of processed graphite.

Together with employment opportunities created, this activity also will utilize the natural resources (graphite) of the country.

The physical needs of man are met by the products of two basic activities, agriculture, and mining. An adequate supply of minerals is therefore essential for the maintenance and improvement of his standard of living. However mineral resources are for all practical purposes considered non-renewable. Sri Lanka is rich in non-metallic minerals and the vein type graphite occurrences of the island constitute an important mineral resource base. The government's present strategy is to develop this sector by encouraging foreign investment. In order to achieve this objective a Mines and Minerals Act No. 33 of 1992 was passed by Parliament. The Geological Survey & Mines Bureau is therefore charged with the function of developing the mineral resources of the island by establishing export-oriented industries. This will be the only means to add value to our minerals for export purposes. The present study is one such example where graphite is involved for export purposes.

### **1.3 Objectives of the IEE Report**

The purpose of Initial Environmental Examination (IEE) study is to ensure that the proposed development project is environmentally sound and sustainable, while the environmental consequences are recognized, and appropriate actions are considered in the project designing phase. The IEE process is conducted to assist the relevant public officials to make decisions that are based

on the understanding of environmental consequences and take action to restore and enhance the environment.

As per the objectives mentioned above, an IEE study was conducted for the proposed graphite mining project at Kotuhena in Maduragoda and the results of the IEE study are discussed in this report.

#### **1.4 Extent and Scope of the Study**

Exploration program of the Proposed Graphite Mining Project covering abandoned Queen's mine complex at Kotuhena near Maduragoda was carried out during the last four-year period, commencing from June 2016 and the final exploration report was prepared and submitted in September 2019. Later, it was approved by the GSMB.

The purpose of the exploration program was to study technical feasibility, and economic viability of the project. Therefore, the accuracy and preciseness of the feasibility study was limited to the level of this purpose.

As the outcome of the exploration program, economically viable graphitebearing vein systems were found below the 25m depth, covering the abandoned Queen's Graphite Mine Complex and the results are suitable for continuing mining below the 25m depth.

In order to obtain an IML-A category mining license to open up graphite mine at the identified area (Queen's Mine at Kotuhena area), it is required to undergo an environmental study for a mining project of this nature. For this purpose, RS Mines (Pvt) Ltd. has contacted Provincial Environmental Authority (PEA) in NW Province in order to discuss the procedure of conducting the environmental study. After having a scoping meeting with relevant government agencies, PEA in NW Province has issued a Terms of Reference (TOR) to the RS Mines (Pvt) Ltd. to undergo an Initial Environmental Examination (IEE) study prior to issuance of mining license. After obtaining the Environmental Clearance, RS Mines (Pvt) Ltd. could obtain IML-A category mining license from the GSMB.

The TOR for the IEE study was issued by the Provincial Environmental Authority of NW Province, which is the Project Approving Agency (PAA) of this project.

Scope of the study extends into the assessment of existing physical, biological, socio-economic, archaeological, and cultural aspects and expected changes to such aspects in the study area during the construction and after implementation of the project. The study area would be the project area and the impact area from the boundary of the project area.

The IEE study was carried out based on the results of the exploration program together with required additional information gathered during the IEE field study, as per the TOR. However, some of the items of the IEE study may not be fulfilled the required technical information for the implementation of the project. These details will be discussed during the design stage.

### **1.5 Approvals Required for the Project from Other Agencies for Implementation of the Project**

Following approvals are needed for the implementation of the project

1. Environment clearance from the Provincial Environmental Authority of NW Province.
2. Mining License from the Geological Survey and Mines Bureau.
3. Environmental Protection License (EPL) from the Provincial Environmental Authority of NW Province.
4. Clearance from the Divisional Secretary of Ridigama for implementation of the project (Annex – 1.4)
5. Clearance from Ridigama Pradeshiya Sabha (Annex – 1.4A)
6. Clearance from Department of Archaeology (Annex – 1.4B)
7. Clearance from Urban Development Authority (Annex – 1.4C)

### **1.6 Brief Outline of the Methodologies and Technologies Adopted in IEE Preparation**

Most of the exploration program (reconnaissance survey, detailed geological mapping, geophysical investigation, land surveying, rehabilitation of old workings, sample analysis and data evaluation) was conducted by the Technical Consultants of RS Mines (Pvt) Ltd. while only the drilling investigations were

conducted by the GSMB. The entire exploration program was conducted between June 2016 and September 2019.

A multi-disciplinary team of consultants undertook the preparation of the IEE report. After having discussions with the client, the scope of work to be carried out and the reporting formats were finalized.

A work plan was then prepared, methodology defined, and the work schedule of individual consultants was determined according to their specialty.

The next stage was the evaluation of impacts identified during the scoping exercise and recommended mitigatory actions. A monitoring plan was then developed to include all monitoring activities recommended by the consultants. Finally, the inputs of all the consultants were brought together into the suggested format of the IEE Report. This report is written in connection with the terms of reference forwarded to the Project Proponent by the Central Environmental Authority.

In compliance with the TOR, the consultants covered all relevant issues identified therein by adopting following procedures.

- Regular meetings with the project proponent.
- Literature study of the available printed materials on the project area
- Several field visits to project area and gathering information on all required physical, biological, and sociological aspects, identifying their expected impacts and suggesting mitigatory measures.
- Collection of data and information from government offices such as Meteorology Department, Agrarian Services Department, National Building Research Organization (NBRO), Geological Survey & Mines Bureau (GSMB), National Water Supply & Drainage Board (NWS&DB), Water Resources Board (WRB), Ridigama Divisional Secretariat, Ridigama Pradeshiya Sabha, and other government offices around Ridigama.

As a part of the survey, data related to socio economic environment within the proposed project area and the vicinity was collected as follows:

- A simple questionnaire was developed to collect socio economic data based on the TOR given by the Provincial Environment Authority of Northwestern province of Sri Lanka.
- Household surveys were conducted covering the proposed project area and the vicinity within an area of around 500m radius from the project site and field observations were carried out within the area covering a radius of 2km from the proposed project area.
- Interviews were conducted with prominent people in the area including officials at grassroots level, key informants, and villagers.
- All households in the above study area were interviewed.
- Secondary data were collected, and relevant documents reviewed.
- Overall socio-economic effects that are predictable due to the proposed project were discussed with relevant officials & the project proponent.

## **1.7 Main Beneficiaries of the Project and Expected Socio-Economic Effects**

### **Main Beneficiaries of the Project**

It is envisaged that Sri Lanka will undoubtedly benefit with the establishment of proposed graphite mining and processing project in addition to the benefit gain by the project developers.

It is also expected that the project proponent will use latest techniques and other inputs in connection with the export oriented facility to be established in the Maduragoda area near Dodangaslanda. With the establishment of this project both direct and indirect employment will be generated in and around the Maduragoda area in Dodangaslanda which is one of the less developed regions in the country.

Furthermore, encouraging an industry of this nature, which is low polluting, is of special value to the project area and the country.

### **Expected socioeconomic effects**

#### **Effects on the country's economy**

Graphite is one of the most valuable natural resources that could be exported and earn foreign exchange to the country. The country still possesses two or three functioning graphite mines. The proposed project would facilitate the country to earn more foreign exchange. Therefore, the proposed project would

directly be economically beneficial and would facilitate the development of our country.

### **Economic effects due to new employment opportunities**

It will create employment opportunities especially for skilled and unskilled labor, management, and clerical categories, etc. Mining, screening, and transportation will be the main areas that will create more employment opportunities. According to the household study, considerable numbers of people are living in the area and the vicinity expecting jobs in the above mentioned categories from this project. Therefore, Project proponent should have a recruitment policy that would give priority to the residents within the project area and the vicinity in recruitments for jobs. This will be positive impacts on the project area.

### **Effects on local economy**

The project will require manpower to implement and operate the project. It is expected to employ a considerable number of workers which in turn would provide indirect employment to boarding houses and shops. The economic status of the surrounding area will increase income through employment benefits and related work. Therefore, commercial activities in the nearby village centers and town centers will also be increased during the project implementation. It will uplift their standard of living, as they will get an extra income.

## **1.8 Policy, Legal and Administrative Framework with Reference to the Project**

The project will be carried out in accordance with the laws, regulations and standards which are applicable to the project.

The project is situated within the NW Province. Hence, the project will be implemented and managed by adhering to the regulations set out in the North Western Province Environmental Statute No. 12 of 1990. For the proposed development project, an Initial Environmental Examination (IEE) study is a legal requirement, as per the North Western Province Environmental Statute (PES)

The PES is the legislation with powers to control any activity with impacts or potential impacts on the environment of the NW Province of the country. The Provincial Environmental Authority (PEA) of NW Province, which is presently

functioned under the NW Provincial Council is the regulatory body empowered to implement provisions under the North Western Province Environmental Statute (PES). One such provision is the issuance of permits for categories of projects prescribed from time to time by Gazette notification.

The IEE study, which is the first step in safeguarding the environment from possible adverse impacts by the project was carried out according to the Terms of Reference (TOR) issued by the NW Provincial Environmental Authority, the project approving agency (PAA) as per provisions of the North Western Province Environmental Statute.

In addition, following regulations will also to be adhered during the activities of the project.

1. Graphite Mining – Mines and Minerals Act No 33 of 1992 – A valid mining license should be obtained from Geological Survey and Mines Bureau (GSMB) prior to commence graphite mining activities.
2. Environmental Protection License (EPL) should also be obtained from the Provincial Environmental Authority (PEA) of NW Province under the North Western Province Environmental Statute, prior to commence graphite mining activities.
3. Air Pollution due to construction activities – Environmental Protection Regulations under the North Western Province Environmental Statute
4. Water Resources Act – Prevention of pollution of rivers, streams, and other water sources.
5. State Land Ordinance Act – Provides guidelines to the protection of source, course or bed of any public stream, springs, reservoirs, lakes, ponds, lagoons, creeks, canals, aqueducts, etc, and prevention of erosion of soil and preservation of water supplies.
6. Soil Conservation Act – Makes provision for the conservation of soil resources for prevention or mitigation of soil erosion and for protection of

land against damage by floods and droughts. It is possible to declare any area defined in the order to be an erodible area for the purpose of this act.

7. Labour legislation in Sri Lanka is consisted of 25 ordinances and all of them are administered by the Commissioner of the Department of Labour. However, the following are considered as the most important:

Wages Board Ordinance No. 21 of 1941

Workmen's Compensation Ordinance No. 19 of 1934

Trade Union Ordinance No. 14 of 1935

Shops Ordinance No. 19 of 1954

Service Contract Ordinance No. 11 of 1865

Payment of Gratuities Act No. 12 of 1983

Employment of Women, Young Persons, and Children Act No. 47 of 1956

National Child Protection Authority Act No. 50 of 1998

Employees' Trust Fund Act No. 46 of 1980

Employees' Provident Fund Act No. 15 of 1958

8. Pradeshiya Sabha Act No. 15 of 1987

Some activities falling under this Project such as building activities, waste disposal etc. fall under the purview of the local Pradeshiya Sabha and as such activities need its approval.

### **1.9 Compliance with the Existing Conservation and Development Plans of the Area**

Kahatagaha graphite mine is one of the leading graphite mines in the country and it is located in close proximity to this proposed graphite mining project. The Government considered graphite to be one of the leading mineral products in this endeavor that has the potential to create significant foreign investments from the private sector. Although the industry has been alive and thriving for over two centuries, few are aware that Sri Lanka boasts of the purest form of graphite in the world, vein graphite (>95%). These veins of graphite vary between veinlets of less than 1mm thickness to giant veins of over 1m thickness. Sri Lanka is the only place in the world where vein graphite is produced in commercial quantities. With the end of a thirty-decade civil war, the country is now looking at dusting off

the ashes and making its mark on the global economy and the market. Investment program of the government has a priority to earn foreign exchange by exporting graphite as a value added product. Therefore, this project is in compliance with the government development policy.

## **CHAPTER - 2**

### **ANALYSIS OF ALTERNATIVES AND PROJECT DETAILS**

#### **2.1 Analysis of Alternatives**

RS Mines pvt Ltd., was able to reserve one grid unit for exploration and its size is limited to 1km x 1km. All the other surrounding grid units to the reserved grid unit were reserved by different companies.

During the exploration program, reconnaissance survey and detailed geological mapping program were conducted within the entire area covered by the reserved grid unit. Within the reserved grid unit, about 13 abandoned surface shaft and adit structures were identified.

Furthermore, within the reserved grid unit, about 3.5055 ha land section is owned by the company. Within the company owned land, about 4 of the identified 13 abandoned shaft and adit structures, including abandoned Queen's mine complex, are located while rest of the identified abandoned structures are located in outside the company owned land.

As per the exploration results, it is evident that the most promising area for graphite mineralization is identified within the company owned 3.5055 ha land section. Abandoned Queen's mine complex is also located within the company owned land.

Furthermore, when inquired from the landowners of the rest of the identified abandoned graphite mine structures, they have expressed their willingness for conducting exploration activities in their lands and selling such lands to the company.

Hence, exploration activities can be conducted in the rest of the surrounding lands which comprises of other abandoned old mines. Hence, alternatives are available for this project.

## **2.2 Description of the Proposed Project**

### **2.2.1 Location of the Project**

Provincial	:	North Western
District	:	Kurunegala
Divisional Secretariat Division	:	Ridigama
Pradeshiya Sabha area	:	Ridigama
Grama Niladhari Division	:	Kotuhena

### **2.2.2 Extent of the Project Site and Present Use of the Land**

Extent of the Project Area is 3.5055ha.

Present Use of the Land is mainly man modified habitats such as home gardens, coconut plantations and secondary vegetation

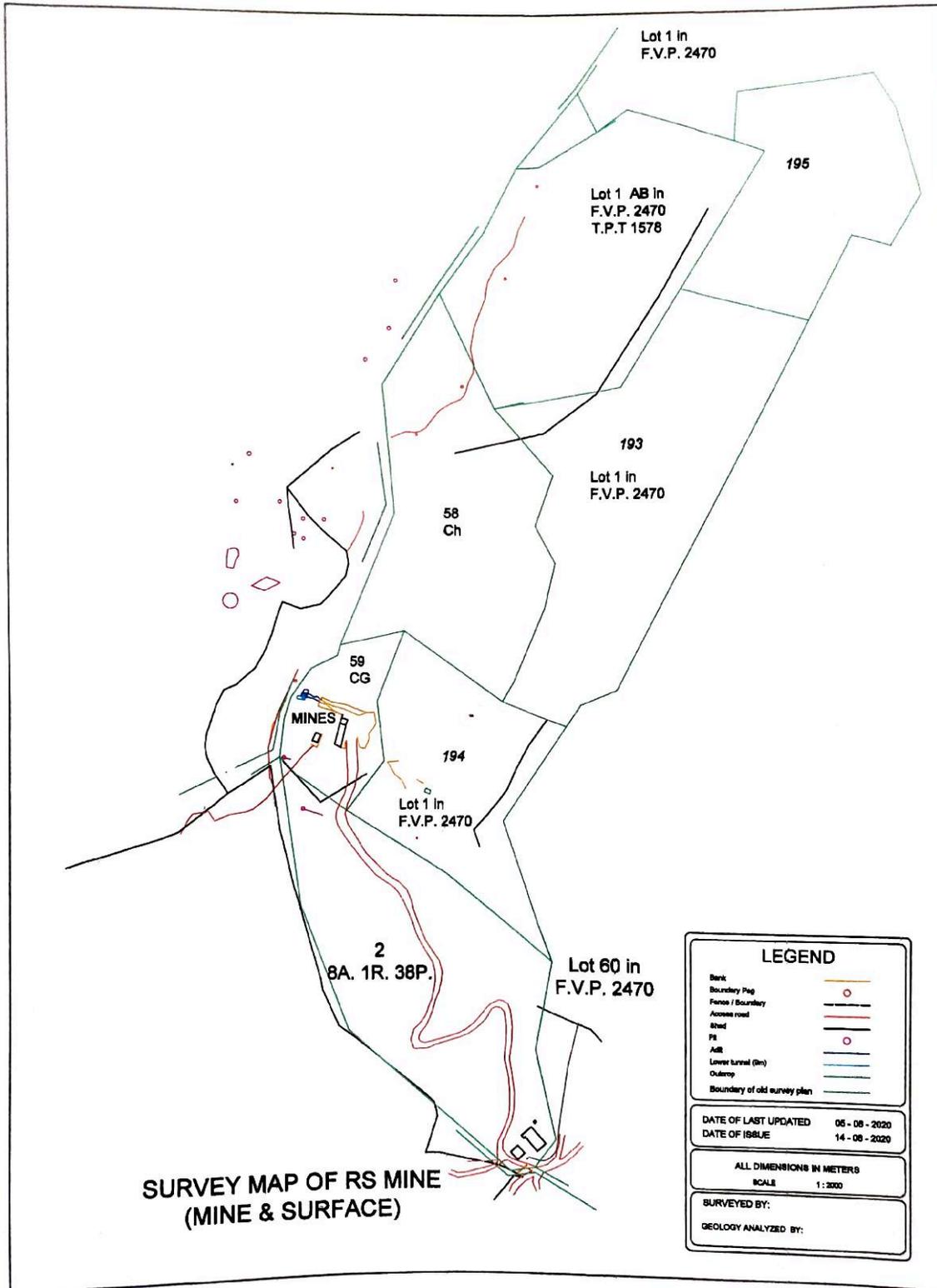


**Plate – 2.2.2:** Presence of man modified habitats such as home gardens, coconut plantations and secondary vegetation within the project area

### **2.2.3 Survey Plan of the Site**

Refer Figure – 2.2.3

Fig. 2.2.3 – Survey Plan



#### **2.2.4 Project Layout Plan (1:10,000 Scale)**

Refer Figure – 2.2.4

##### **2.2.4.1 Mining Plan, Mining Layout and Schedule**

Refer Figure – 2.2.4.1

#### **2.2.5 Ownership of the Project Site (State / Private / Other – Specify)**

Entire area earmarked for the project is a private land owned by the company and is called Thalagahamulla Hen Yaya (Ratamiris Kotuwe Hena). Total extent of the land is 3.5055 ha.

Copy of the land ownership deed is shown in Annex – 2.2.5.

#### **2.2.6 Location Map Indicating the Project Site, Accessibility to the Site, Surrounding Developments and Infrastructure within Radius of 1km from the Site**

Location map indicating the project site is shown in Fig. 2.2.6.

Accessibility to the project site is shown in Fig. 2.2.6A.

Surrounding developments and infrastructure within radius of 1km from the site is shown in Figures - 2.2.6B & 2.2.6C (extracted from Google Satellite Map).

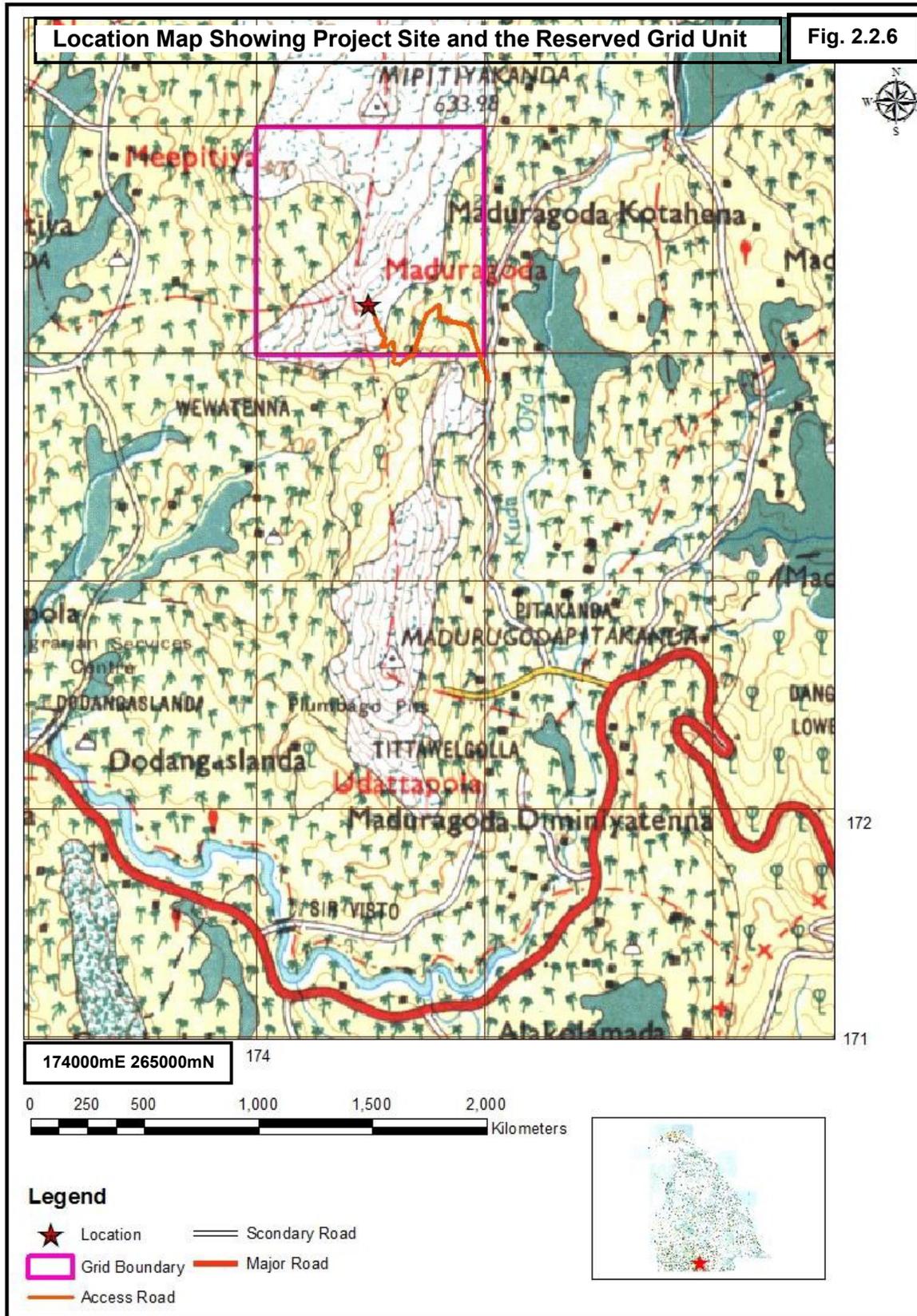
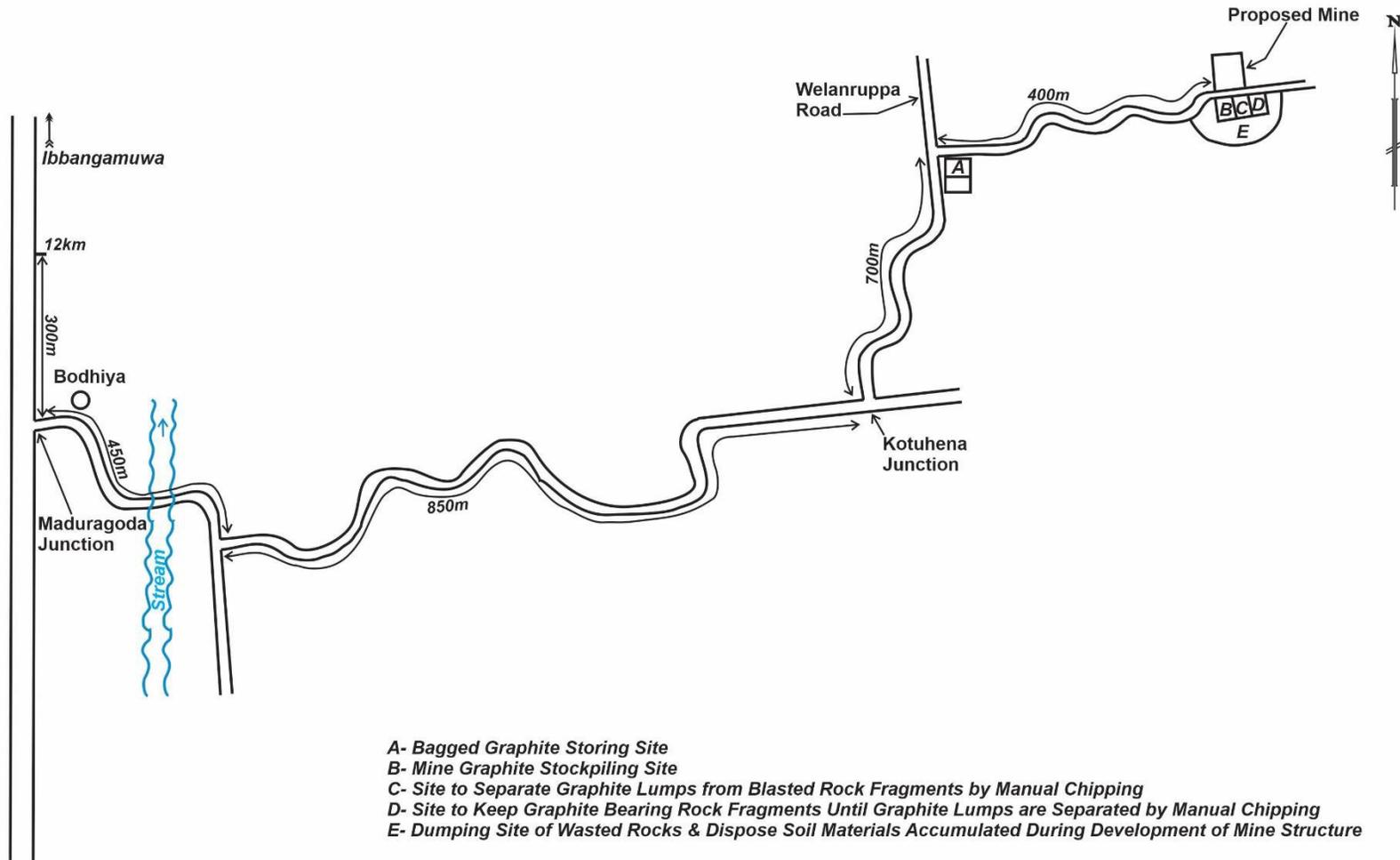
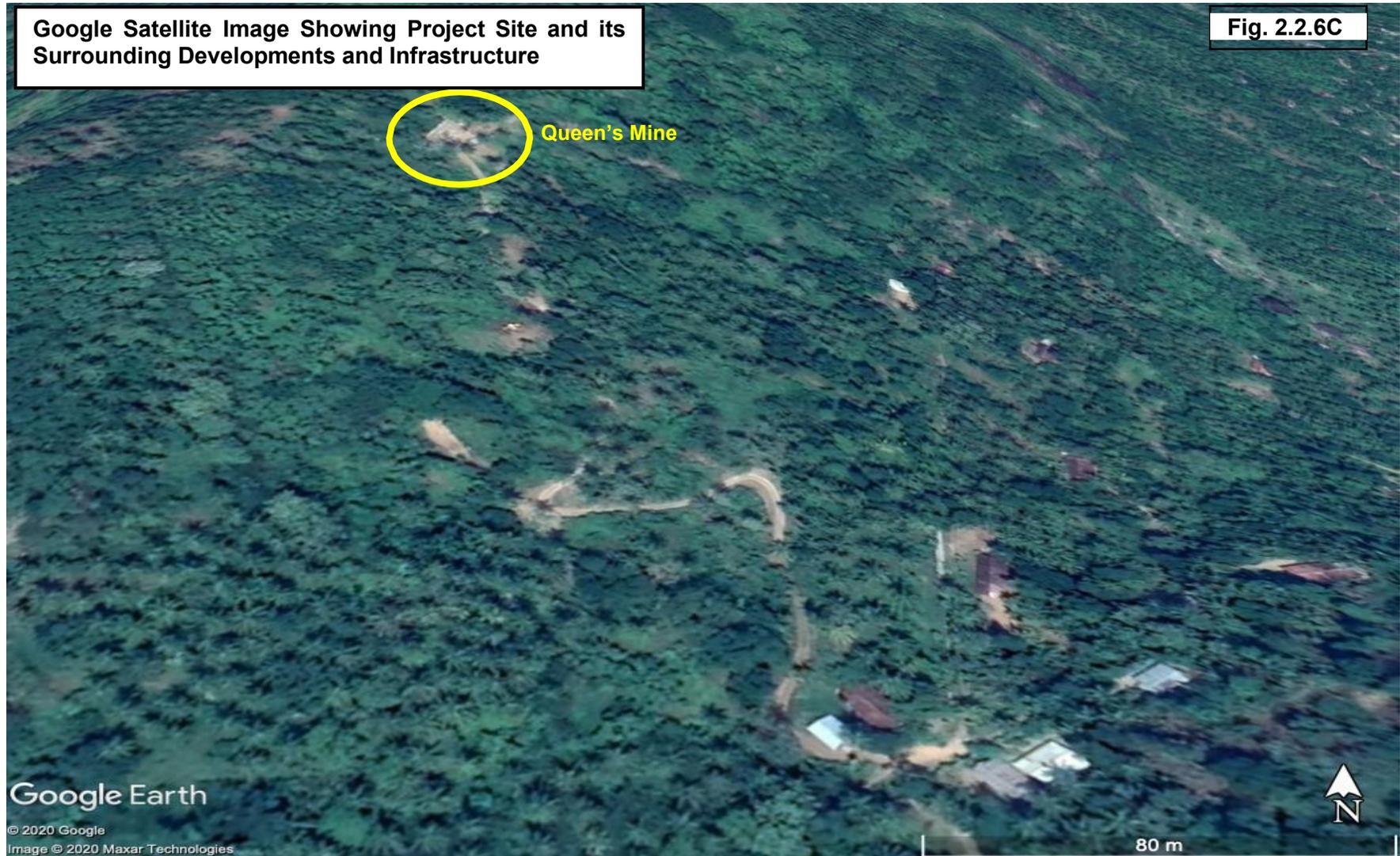


Fig. 2.2.6A

**Sketch Map Showing Accessibility to the Proposed Graphite Mining Site at Kotuhena in Maduragoda Near Dodangaslanda (Kurunegala District)**







**2.2.7 Does the Project Wholly or Partly Fall Within any of the Following Areas**

No.	Area	Yes	No
1.	100m from the boundaries of or within any area declared under the National Heritage Wilderness Act. No. 3 of 1998		X
2.	100m from the boundaries of or within any area declared under the Forest Ordinance (Chapter 451)		X
3.	Coastal Zone as defined in the Coast Conservation Act No. 57 of 1981		X
4.	Any erodible area declared under the Flood Protection Ordinance (Chapter 450)		X
5.	Any flood area declared under the Flood Protection Ordinance (Chapter 449)		X
6.	Any flood protection area declared under the Sri Lanka Land Reclamation and Development Corporation Act 15 of 1968 as amended by Act. No. 52 of 1982		X
7.	60m from the bank of a public stream as defined in the Crown Lands Ordinance (Chapter 454) and having width of more than 25m at any point of its course		X
8.	Any reservation beyond the full supply level of a reservoir		X
9.	Any archaeological reserve, ancient or protected monument as defined or declared under the Antiquities Ordinance (Chapter 188)		X
10.	Any area declared under the Botanic Gardens Ordinance (Chapter 446)		X
11.	Within 100m from the boundaries of, or within area declared as a Sanctuary under the Fauna and Flora Protection Ordinance (Chapter 469)		X
12.	100m from the high flood level contour of or within a public lake as defined in the Crown Lands Ordinance (Chapter 454) including those declared under Section 71 of the said Ordinance		X
13.	Within a distance of one mile of the boundary of a National Reserve under the Fauna and Flora Protection Ordinance		X

**2.2.8 Applicable laws, regulations, standards and requirements covering the Proposed Project: Clearances / Permits obtained or should be obtained from the relevant state agencies and or local authorities attach required copies of the same**

**Applicable laws, regulations, standards and requirements covering the Proposed Project**

The project will be carried out in accordance with the laws, regulations and standards which are applicable to the project.

The project is situated within the NW Province. Hence, the project will be implemented and managed by adhering to the regulations set out in the North Western Province Environmental Statute No. 12 of 1990. For the proposed development project, an Initial Environmental Examination (IEE) study is a legal requirement, as per the North Western Province Environmental Statute (PES)

The PES is the legislation with powers to control any activity with impacts or potential impacts on the environment of the NW Province of the country. The Provincial Environmental Authority (PEA) of NW Province, which is presently functioned under the NW Provincial Council is the regulatory body empowered to implement provisions under the North Western Province Environmental Statute (PES). One such provision is the issuance of permits for categories of projects prescribed from time to time by Gazette notification.

The IEE study, which is the first step in safeguarding the environment from possible adverse impacts by the project was carried out according to the Terms of Reference (TOR) issued by the NW Provincial Environmental Authority, the project approving agency (PAA) as per provisions of the North Western Province Environmental Statute.

In addition, following regulations will also to be adhered during the activities of the project.

1. Graphite Mining – Mines and Minerals Act No 33 of 1992 – A valid mining license should be obtained from Geological Survey and Mines Bureau (GSMB) prior to commence graphite mining activities.

2. Environmental Protection License (EPL) should also be obtained from the Provincial Environmental Authority (PEA) of NW Province under the North Western Province Environmental Statute, prior to commence graphite mining activities.
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**Clearances / Permits obtained or should be obtained from the relevant state agencies and or local authorities attach required copies of the same**

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1. Environment clearance from the Provincial Environmental Authority of NW Province.
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4. Clearance from the Divisional Secretary of Ridigama for implementation of the project (Annex – 1.4)
5. Clearance from Ridigama Pradeshiya Sabha (Annex – 1.4A)
6. Clearance from Department of Archaeology (Annex – 1.4B)
7. Clearance from Urban Development Authority (Annex – 1.4C)

**2.2.9 Brief Description of the Components of the Project and Expected Duration**

## **2.3 Pre Operational Phase**

### **2.3.1 Description of the Ground Preparation Activities (including removal of vegetation, soil layers and stockpiling etc.)**

The land where the mine is to be operated is a private land. It is called Thalagahamulla Hen Yaya (Ratamiris Kotuwe Hena). Total extent of the land is 3.5055 ha.

Mainly man modified habitats such as home gardens, coconut plantations and secondary vegetation are identified on the ridge slope covering the proposed mine structure.

RS Mines Pvt Ltd. had initially obtained an Artisanal Mining License (AML - A) (Annex – 1.1) from the GSMB in 2009 to commence mining activities in the abandoned Queen’s mine.

Soon after obtaining the mining license, the company had initiated mining activities as per the given guidelines in the mining license, covering the abandoned Queen’s mine. So, the company had initially began cleaning the abandoned shafts and adits of Queen’s mine complex and continued mining activities up to 25m depth below the surface.

When commencing mining activities, the company has cleared the hilly ground area around the mouth of the mine structure. During the cleaning process, the company had prepared a horizontal ground area in front of the mine mouth by excavating the ridge slope, in order to temporarily stockpile mined out graphite fragments and graphite bearing rocks until they are separated by manual chipping (Plate – 2.3.1).

After excavating the hill slope, the company has erected a retaining wall covering the disturbed hill slope in order to strengthen it (Plate – 2.3.1).

In addition, company will erect about 15feet high rock wall along the 401m contour line in further bottom section of hill slope in order to extend land area to dump waste rocks collected when commencing mining activities. When dumping rock fragments within this dumping site, few tree species will be destroyed.

Before commencing mining activities, it is necessary to enlarge the initial adit structure located at the entrance of the mine. During adit enlarging process,

some rock blasting will have to be carried out. Blasted rocks will be dumped within the area selected for waste rock dumping site. Space available in front of the mine entrance will be used as stockpiling sites (Fig. 2.3.1).



**Plate – 2.3.1:** Horizontal ground area prepared in front of the mine entrance to stockpile mined out graphite fragments and graphite bearing rocks until they are separated by manual chipping

In addition, about 400m long existing access road leading to the mine site from the company office premises will have to be upgraded with developing roadside drainage path. It is recommended to apply a bonding material like Tar on the surface of the access road. Roadside drainage path will be rock paved.

In addition, a drainage path will also be erected covering the hill slope of the mine site and stockpiling sites (mined out graphite fragments stockpiling site, graphite bearing rocks stockpiling site and waste rocks dumping site).

Office building has already been built at the entrance point to the land and it is located in about 400m away from the mine entrance. In the front yard of the office building, sorted mine graphite stockpiling site is located (Fig. 2.3.1).

Furthermore, additional waste rocks / soil dumping site has also been located near the office building (Fig. 2.3.1). Not a single tree species will be affected when waste rocks are dumping in this site.

Rock pave drainage path will also be developed covering the office building, sorted mine graphite stockpiling site and additional waste rocks / soil dumping site (Fig. 2.3.1).

Existing access road to the project site from the Kotuhena Junction will also be developed with erecting roadside drain system under this project.

During the establishment of above mentioned project related structures, some land clearing process had to be performed. Hence, some ground sections covering these structures had been exposed. Therefore, some soil erosion process could be expected from these soil exposed sections. Hence, it is recommended to grass turfed in order to cover these soil exposed sections.

In addition, when establishing mine graphite stockpiling site, waste rocks and soil dumping site, some ground sections will have to be exposed. Hence, soil erosion process could be expected from the soil exposed boundary sections of these sites. Hence, it is recommended to level / slope (in 1:4 ratio) / erect rocky retaining walls / grass turfed covering the boundary sections of these sites in order to cover these soil exposed sections.

Furthermore, in order to erect built-up drain system and retaining walls covering the project area, minor earth moving activities are needed on the ground surface of the downward hill slope. The excavated soils will be used for level these sites. Blasted rock fragments will be used for erection of retaining walls covering downward slopes of waste rocks and soil dumping site.

After erecting built-up drain system and retaining walls covering the downward slopes of these structures, all the soil exposed sections will be grass turfed in order to avoid soil erosion from the disturbed sections of the downward hill slope.

### **2.3.2. Construction Details of all major components and other construction activity details and establishment of shafts / adits / inclines**

### **2.3.3 Construction of New Roads or Improvements to Access Roads (if any)**

There is no necessity to erect new roads under this project. However, it is required to develop existing access roads.

About 400m long existing access road leading to the mine site from the company office premises will have to be upgraded with developing roadside drainage path. It is recommended to apply a bonding material like Tar on the surface of the access road. Roadside drainage path will be rock paved.



**Plate – 2.3.3:** Poor condition of access road leading to the mine site from the office premises

At places of this road, minor collapsing has been identified in roadside slope embankment due to steep cutting (Plate – 2.3.3A). Hence, it is recommended to shape the roadside slope embankment in 1:4 ratio and allow creepers to grow along the slope in order to avoid further collapsing. Otherwise, it is recommended to identify such places and erect rock paved retaining walls.



**Plate – 2.3.3:** Minor collapsing of roadside slope embankment at places along the access road

Existing access road to the project site from the Kotuhena Junction will also be developed with erecting roadside drain system under this project.

During the development of above mentioned access roads, some soil removing, and filling process will have to be performed. Hence, some ground sections covering these roads will be exposed. Therefore, some soil erosion process could be expected from these soil exposed sections. Hence, it is recommended to cover these soil exposed sections (road surface with bonding material like tar and the drain path by rock paving).

## **2.4. Operational Phase**

### **2.4.1. Mining Activity**

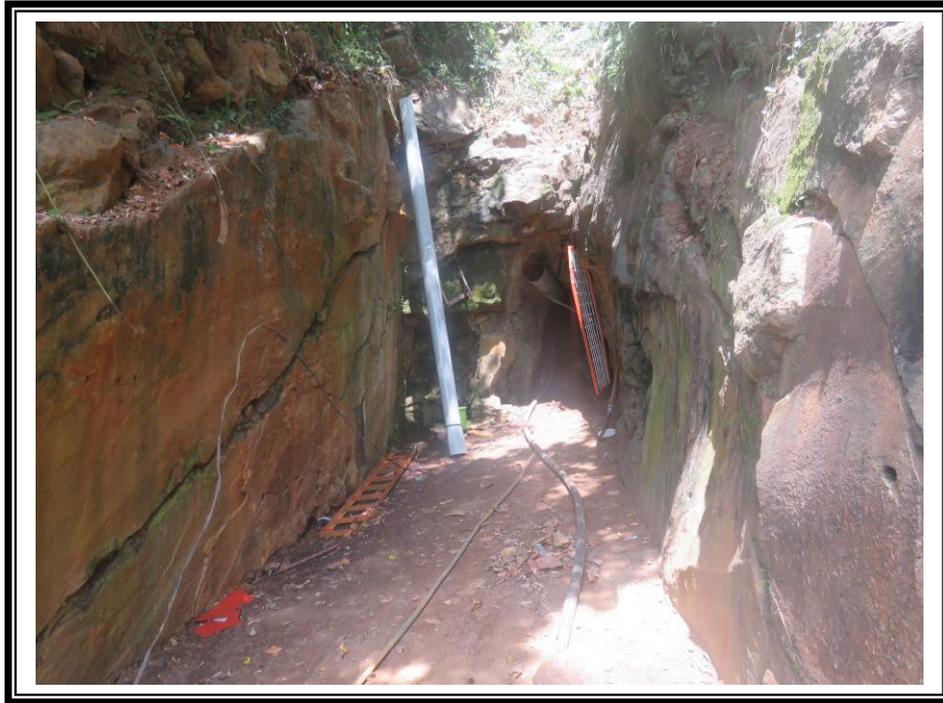
#### **2.4.1.1. Proposed Mining Area**

Proposed mining area consists of 3.5055 Hectares in a land called Thalaghamulla / Ratamiris Kotuwe Hena in the 539 Kotuhena GND in Kotuhena village in Ridigama Divisional Secretariat Division in Kurunegala District. Detailed exploration program has been conducted covering the proposed mining site. As per the exploration report, underground vein system consists of seven veins, extend throughout the land and beyond. But the mining will be strictly confined to the licensed area. Depth of mining as initially planned will be 100m. However, depending on the extent and nature, this may be changed with future development.

There are no houses or public roads identified within the selected land. There are neither residences nor sensitive structures located within the 200m radius of the project area

The area has not been declared as a landslide-proven zone and there is no evidence about previous landslides around the vicinity.

Cleaning of the abandoned mine complex has identified that the proposed mine comprises of abandoned 2 shafts and 3 adit structures (Plates – 2.4.1.1 & 2.4.1.1A). During the clearing process of the mine structure, new drives were found and observed remaining graphite veins in their walls (Plate – 2.4.1.1B).



**Plate – 2.4.1.1: Mine Entrance**



**Plate – 2.4.1.1A: Cleaned Adit Structure**



**Plate – 2.4.1.1B:** Presence of a Graphite Veins in the mine

**2.4.1.2. Deposit Conditions, Volume and Type of Minerals Available at the Site**

**Deposit Conditions**

The vein graphite deposits of Sri Lanka are located within the Precambrian high grade metamorphic terrain dominated by granulite facies rocks. Vein graphite has been interpreted as being of solid phase lateral secretion origin, derived by hydrothermal solutions or of biogenic origin. Based on what is known on the

composition of the fluids under granulite facies conditions and the role of these fluids in their transport through the crust, the origin of the graphite is proposed to be the direct consequence of granulite facies metamorphism in the presence of a CO<sub>2</sub> rich fluid. This CO<sub>2</sub> rich fluid could promote hydraulic fracturing and precipitation of vein graphite. Textures and structures of the vein graphite indicate syntectonic deposition by a crack-seal process under granulite facies metamorphic conditions. This model is supported by temperature estimates on graphite based on XRD data and stable carbon isotopes of graphite that suggest a deep-seated crustal origin.

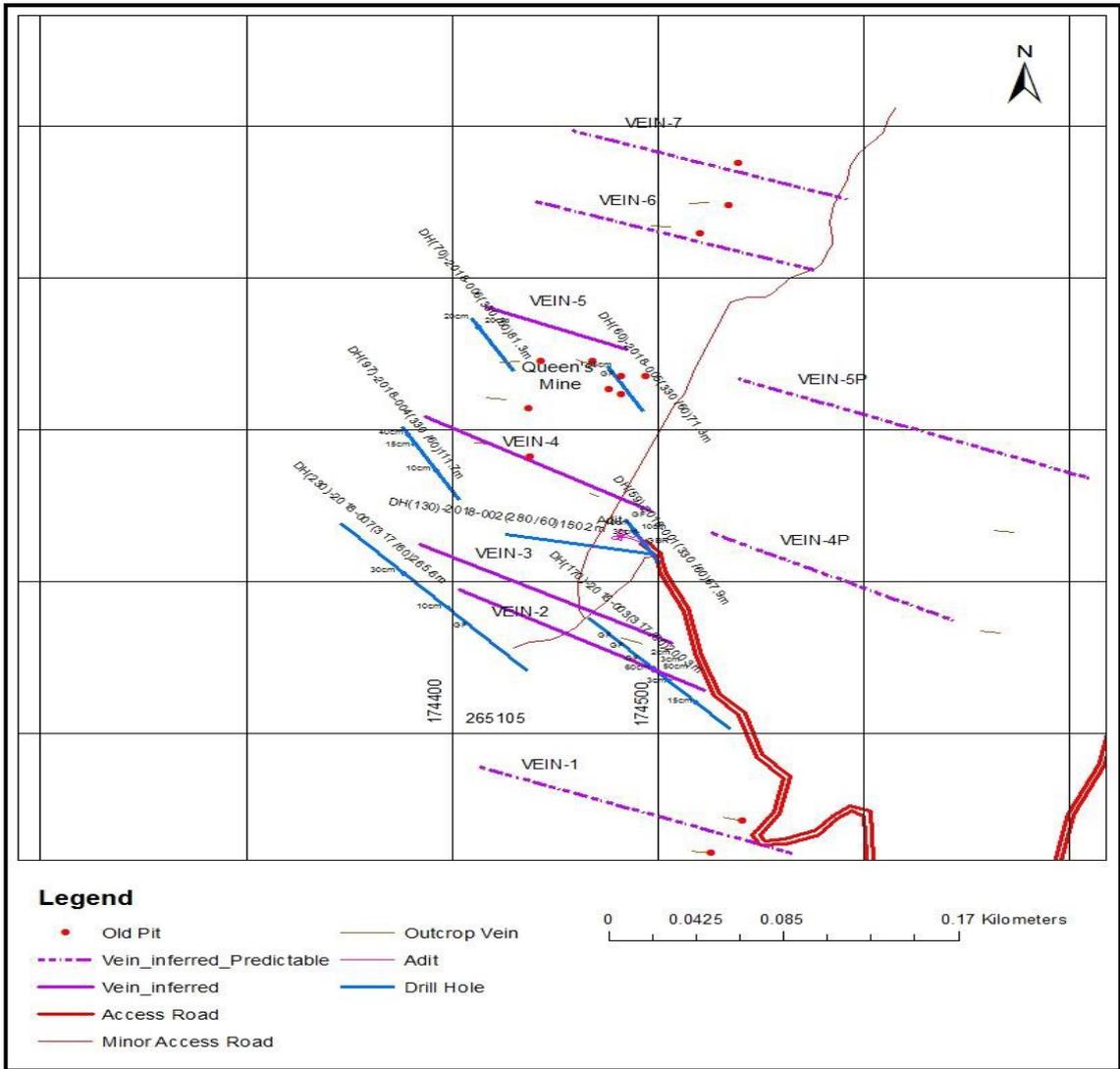
The general geology of the area shows that the graphite occurs as veins in Garnetiferous quartzofeldspathic gneiss rock which is a hard rock.

Historically, graphite mining had been prolific in the area. It can be verified with the available surface indications as well as by studying the abandoned mines in the area. Recent core drilling carried out within the property has proved mineralization of graphite in 7 major veins (Pl. Refer Final Graphite Exploration Report of RS Mine at Kotuhena in Kurunegala District and Table – 2.4.1.2 and Fig. 2.4.1.2) and the area is appeared to be rich in graphite. Veins are running in a direction of NWW-SEE and steeply dipping and are extending longitudinally.

A detailed examination of available drill cores has indicated that all the holes have traversed through number of graphite veins / veinlets (with each vein / veinlet having varying thickness of 6 – 30cm) (Plate – 2.4.1.2).



**Plate – 2.4.1.2:** About 30 cm graphite vein intersected by one of the drill holes



**Figure – 2.4.1.2:** Existing graphite vein pattern in the proposed mining area

**Table – 2.4.1.2: Mineralization of Graphite in 7 Major Veins Identified during Drilling**

Hole Id	Sample Id	Depth from	Depth to	Lithology
DH001	BOX5	29.1	30	GBR
DH001	BOX9	45.9	48.3	10cm
DH001	BOX9	48.54	48.84	30cm
DH001	BOX9	51.33	51.43	10cm
DH001	BOX1	61.6	61.8	QzBGr
DH003	SA8	48.73	48.88	15cm
DH003	SA25	86.7	106.6	3cm
DH003	SA32	106.65	107.5	50cm
DH003	SA36	109.65	109.7	3cm
DH003	SA38	110	110.6	60cm
DH003	SA40	111	111	2cm
DH004	SA6	45.9	46	10cm
DH004	SA13	86	86.15	15cm
DH004	SA16	99.6	100	40cm
DH005	SA12	62.3	62.65	35cm
DH006	SA14	67.9	68.1	20cm
DH006	SA16	68.4	68.6	20cm
DH007	SA11	114.5	114.6	10cm
DH007	SA16	175.3	175.9	30cm
DH001	BOX12	62.3	62.35	GF
DH002	BOX09	45.2	45.25	GF
DH003	SA42	112.1	112.15	GF
DH003	SA55	150.3	150.35	GF
DH003	SA58	160.35	160.4	GF
DH005	SA9	48.8	48.85	GF
DH007	SA8	86.7	86.75	GF

**Quality of Graphite Identified within the Proposed Mining Area**

In order to check the quality of the graphite identified within the proposed mine, a composite sample was prepared by collecting intersected graphite veins during diamond drilling and it was analyzed at the analytical laboratory of GSMB. According to the test results, 95.73% of carbon percentage is observed in the compositesample.



**භූ විද්‍යා සමීක්ෂණ හා පවල් කායකීංශය**  
**புவிச்சரிதவியல் அளவை, சுரங்கங்கள் பணியகம்**  
**GEOLOGICAL SURVEY & MINES BUREAU**

නො. 569, ඊපිටමුල්ල පාර,  
පිටකෝට්ටේ දි. මහල.  
இல: 569, எப்பிட்டமுல்லை வீதி,  
பிடகோட்டே, இலங்கை.  
No.: 569, EPITAMULLA ROAD,  
PITAKOTTE, SRI LANKA.

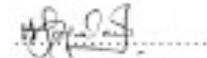
**RESULTS OF CHEMICAL ANALYSIS**

Laboratory Reference No. : AL/18/38/GEN-31  
Material : Graphite  
No. of Samples : 01  
Submitted by : R.S.Mines (Pvt) Ltd.  
Submitted Date : 05.04.2018

Parameter	Results
Percentage of Carbon	95.73%
Density	2.2g/cm <sup>3</sup>

Note. 1: The analysis on Carbon was performed on the powdered sample dried at 105°C  
2: The density was determined after visible rock fragments were removed.

  
Authorized signatory

  
H.A.P. Jayalath  
Analyst

06.04.2018  
Date

**Y. P. Shemalle Siriwardana**  
Chief Chemist  
Analytical Laboratory  
Geological Survey & Mines Bureau  
No. 569, Epitamulla Road,  
Pitakotte.

Total Indicated Ore Resources of graphite within the area covered by Kotuhena Graphite Mine Complex has been estimated with the available drilling data and the cleaned main shaft, cross cuts and drives and is around 52,916 metric tons (Table – 2.4.1.2). In addition, predictable reserves are about 53,131 metric tons (Table – 2.4.1.2). Therefore, total indicated, and predicted reserves are about 106,047 metric tons.

**Table – 2.4.1.2: Total indicated ore reserves. (Pl. Refer Final Graphite Exploration Report in RS Mines at Kotuhena area)**

Ore resource computation for the block from the vein																			
Level/Vein	Block	Length of the block		Height of the block		Area of the block	Thicknesses				Length of influence	Average block thickness	Block volume	Density	Tonnage	Resource category (type)			
(symbol)	(symbol)	top drive	bottom drive	west side	east side	$S_b$	top drive	bottom drive	West side	East side	P	$W_{ab}$	$V_b$	$\rho$	$R_b$				
		$L_{top}$	$L_{bottom}$	$H_w$	$H_e$	$S_b$	$W_{top}$	$W_{bottom}$	$W_{west}$	$W_{east}$	$C_1+C_2+C_3+C_4$	$C_{15}/C_{10}$	$C_5^*C_{16}$	annex II	$C_{17}^*C_{18}$				
		[m]	[m]	[m]	[m]	$(m^2)$	[m]	[m]	[m]	[m]	[m]	[m]	$(m^3)$	$(t/m^3)$	(ton)				
Column number		1	2	3	4	5	6	7	8	9	10	16	17	18	19	20			
Vein1	A	174.6	159.00	99.00	28.8	10225	0.00	0.13	0.00	0.00	159	0.125	1278.13	2.29	2927	INF			
Vein1	B	159	159.00	20.00	20	3198	0.13	0.00	0.00	0.00	159	0.125	399.75	2.29	915	INF			
<b>Total level</b>						13423						0.125	1677.88	2.29	3842				
Vein2	A	173.4	159.00	143.60	82.4	18610	0.00	0.70	0.00	0.00	159	0.700	13027.00	2.15	28008	INF			
Vein2	B	159	159.00	20.00	20	3180	0.70	0.00	0.00	0.00	159	0.700	2226.00	2.15	4785	INF			
<b>Total level</b>						21790						0.70	15253.00	2.15	32794				
Vein3	A	158.9	150.9	82.6	32.6	8699	0.00	0.45	0.00	0.00	150.9	0.450	3914.55	2.15	8416	INF			
Vein3	B	150.9	150.9	20	20	3018	0.45	0.00	0.00	0.00	150.9	0.450	1358.10	2.15	2920	INF			
<b>Total level</b>						11717						0.45	5272.65	2.15	11336				
Vein4	A	93	93	44.2	45.9	4194	0.00	0.38	0.00	0.00	93	0.375	1572.75	2.15	3381	INF			
Vein4	B	93	93	20	20	1860	0.38	0.00	0.00	0.00	93	0.380	706.80	2.21	1562	INF			
<b>Total level</b>						6054						0.38	2279.55	2.1686	4943				
<b>Total vein(Ton)</b>						52,984						0.462	24,483	2.16	52,916				

Ore resource computation for the block from the possible vein(predictable)					
Vein	Area of the block	Average Block thickness	Density	Tonnage	Resource category (type)
Vein1	8553	0.462	2.17	8575	INF
Vein4B	13129	0.452	2.17	12877	INF
Vein5B	17436	0.452	2.17	17102	INF
Vein6	7426	0.452	2.17	7284	INF
Vein7	7436	0.452	2.17	7294	INF
<b>Total Vein(Ton)</b>				<b>53,131</b>	
<b>Grand Total (Ton)</b>				<b>106,047</b>	

Number of minerals is associated in the country rocks (i.e., quartz, feldspar, mica, hypersthene, etc) at the site and are occurred as a mixture of minerals.

Only graphite is the economically mineable mineral available at the Site

### **Future Growth of Reserves**

As will be explained further under the section of Mine Development, as the underground infrastructure expands laterally and to the depth with the excavation of drifts and winzes, addition to reserves will build up the reserve position from the current indicated type purely based on the opened-up areas available from past mine operations. Reserve-build-up will bolster the confidence in future mine planning. However, continuous exploration drilling is strongly recommended to be conducted as it will give directions for future development of the mine.

#### **2.4.1.3. Mining Plan**

Mining plan will include the following and details are given later.

- Mine Design: Access road, Shaft size, shaft lining, depth, installation of generator, compressor and water storage tanks, office, workshop
- Mine development: level interval, stope length, Number of stopes, raizes and winzes
- General Stope Design: Method of stoping; Underhand or overhand.
- Graphite Mining Method: Cut and fill method is selected as the vein width is small (30-45cm).
- Waste management: Waste country rock is used for refilling under the proposed mining method and any excess is lifted to the surface

### 2.4.1.4. Mining Lay Out and Schedule

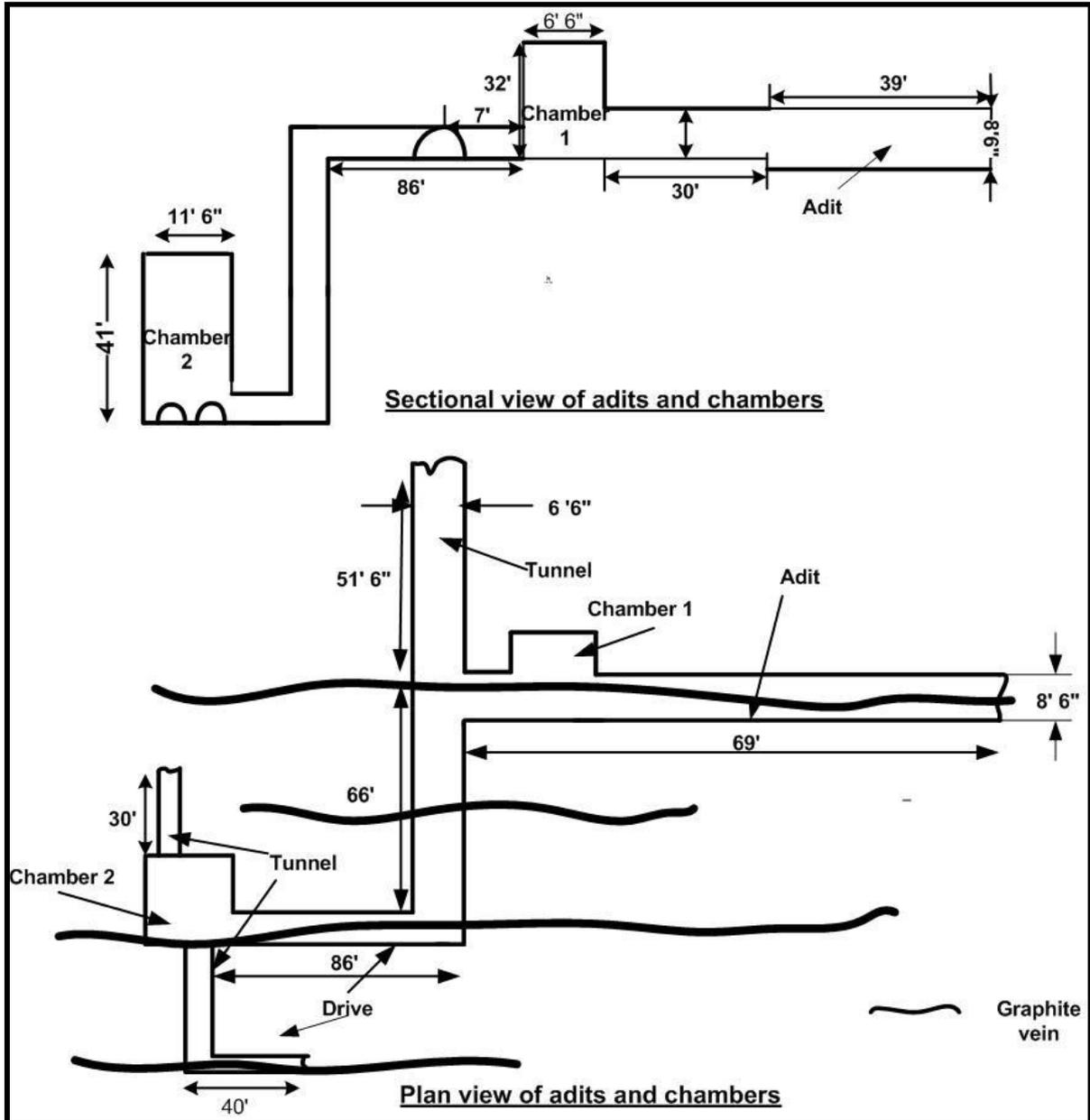
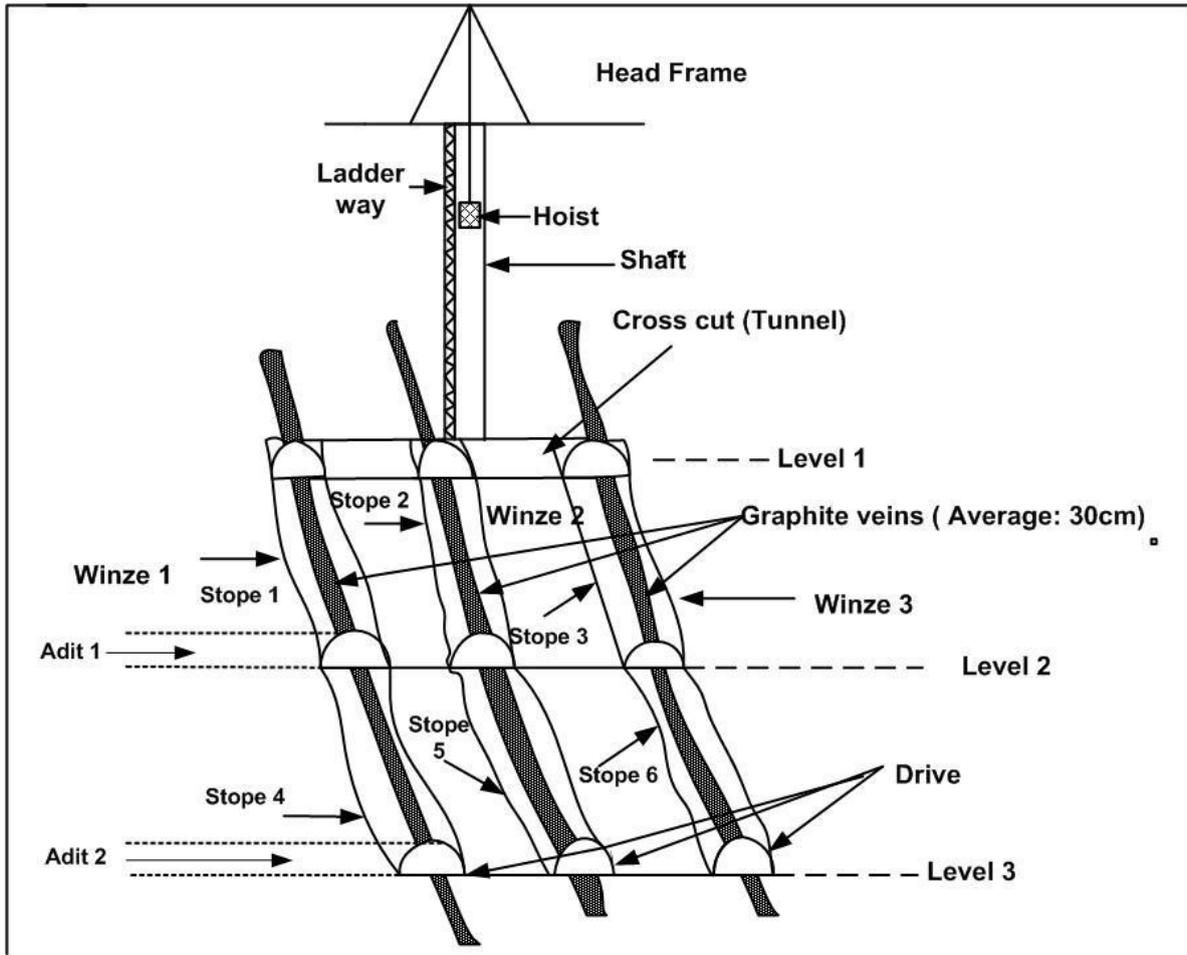
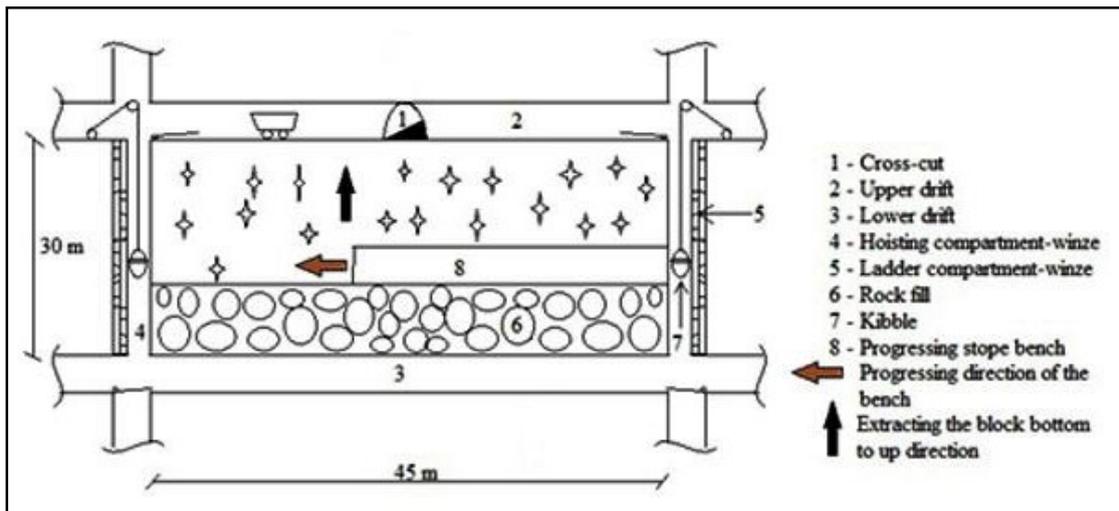


Figure – 2.4.1.4: Existing Adits and Other Developments

• **Mining Layout**

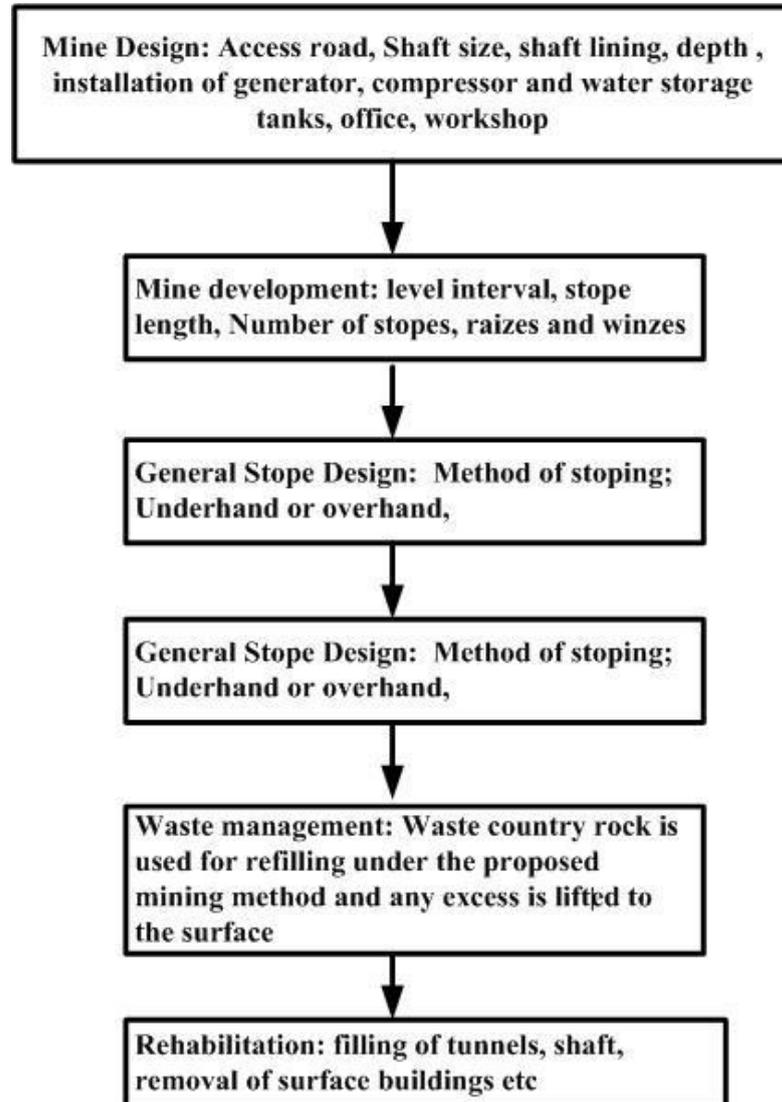


**Figure – 2.4.1.4(a):** Typical Mining layout plan in a situation as in RS mines (only 3 veins shown)



**Figure - 2.4.1.4(b):** Typical Mining layout plan in Stopping (work site)

- **Mining Schedule**



**Figure – 2.4.1.4(c): Mine schedule**

#### **2.4.1.5. Method of Mining**

The proposed mining method to be used at the graphite Mine is:

- i. Hand-held Mining using an airleg and machine pick, powered by compressed air.
- ii. Hand-held mining requires a person to operate the airleg and selective mining machinery.
- iii. Stope areas will be divided into production blocks, nominally the length of vein strike or 30-40m, whichever is less and 30-40m vertical along dip.
- iv. A crown pillar will be left in place at the top of each mining block to ensure final support is in place for the last production lift of each block

- v. On any level, there will be hand-held stope mining. This will involve mining the ore zones, by a method of mining a slot nominally of 0.6m advance or whatever is practical. Where required ground support including rock bolts will be used.

Under the given geo-mechanical conditions, the proposed mining method for the steep-dipping graphite veins within weak hanging and footwalls will be **Cut-and-Fill method** (Refer Figure 2.4.1.5). The block of graphite with upper and lower drifts serving as horizontal boundaries and two winzes located 30-40 m apart serving as the vertical boundaries makes one unit of production. Extraction of the block starts with the initial horizontal slice starting from the lower drift and working upwards. In this manner the slices progress upwards to the upper drive in a zig-zag pattern. The lower bench or slice is filled while the upper slice is taken. Adequate roof support of the bench is essential in this extraction work. Roof support timber or second-hand rail cap is recommended. For hanging and foot wall supports, use of rock bolting is recommended.

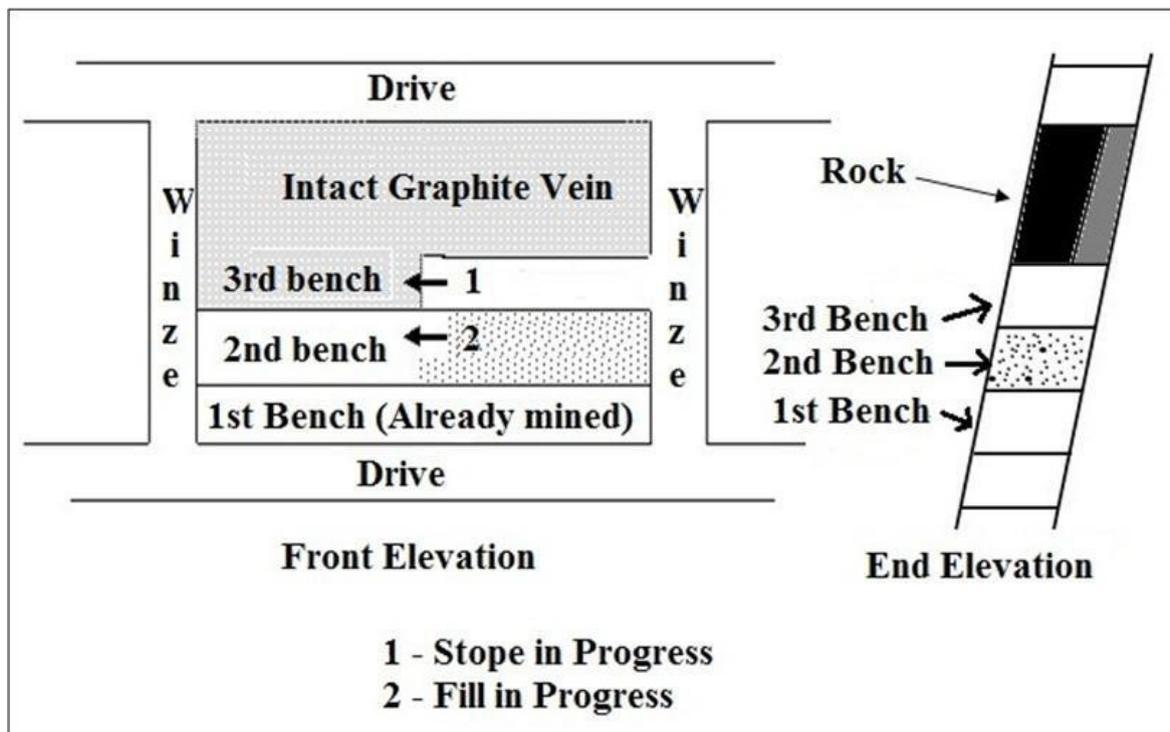


Figure - 2.4.1.5: Cut-and-Fill mining method

#### 2.4.1.6: Working Depth (Below Ground & Mean Sea Level)

Depth of the proposed shaft is 100m and Present depth of the mine is 24m below the entrance level of adit and 377 msl (bottom level).

**2.4.1.7. Mode of Entry to the Mine (Shaft, Adit, Incline)**

The main method of entry will be by a shaft of 10ft x 6ft (3 x 1.8m). A 6ft x 6ft (1.8x1.8m) hoisting section and 4ft x 6ft (1.8 x 1.2m) ladder way for emergency also exists. One adit of 4ft x 4ft will be created. One already present adit will be cleared up and joined the shaft as an alternative entrance and for dewatering.

**2.7.1.8. Details of Machineries in Underground and on Surface (Mining, Transportation and Material Handling) with Production Capacity**

Basic machinery and equipment required at the commencement of production activity is listed out below. With the ramping-up of production over the years with proper mine planning and design, appropriate equipment should be acquired, and existing machinery and equipment should be replaced. One of the major investments at the start of production will be a suitable electric hoist enabling cage hoisting through the main shaft.

**Table – 2.7.1.8: Machinery and Equipment**

Type	Capacity	Initial Quantity
Generator	250 kVA	01 No.
Drill machine with integral leg drill		04 No.
Compressor	100 kW	01 No.
Axial-flow ventilation fan	4" Dia	01 No.
Blasting Ohm meter		01 Nos.
Exploder / Shot firer		01 Nos.
Gas meter for oxygen, combustible gases		01 No
Vane anemometer		02 No
Compressed air –operated hoists – for winze hoisting	01 mt. capacity	03 Nos
Site utility vehicle to be used as an ambulance.(At all times stationed at the worksite when men are at underground work)		01 Nos
Kibbles – Bottom dumping	500 Kg	06 nos.
Trolley chassis and bins		6-7 Nos.
Hoist certified for men hoisting (Within the first year)	5 tonnes, 440V	01 No
Track rails (24-inch gauge)		Adequate stock of lengths
GI pipe – 1-inch, ½ –inch diameter		Adequate

		stock lengths	of
Plasma cutter/ Steel cutting tool		02 No	
Submersible pumps (Depending on the water inflow)		03 Nos	
Lightening conductor		01 No	
Suitable wire rope lengths for 02-03mt hoisting capacity with adequate safety factor.			

Basic consumables constitute timber logs, drill bits, planks, chisels, SH rails, hammers ventilation ducting, hand saws, shovels, pans, rock bolts, Plasma cutter/ Steel cutting tool Hitches, tamping rods, blow pipes, bull-dog clips, basic workshop tools, PPE equipment, wire ropes for winze hoisting, required tools for mining, mechanical and electrical repairs.

**2.4.1.9. Subsidence (Maximum Predicted Subsidence, Max Slope Change, Impact on Surface Features Like Natural Drainage Pattern, Houses Water Bodies, Water Table, etc.)**

**Maximum Predicted Subsidence**

There will be no subsidence since all the tunnels and drifts are supported and stoped out area is filled with broken rocks from development work and excavated winzes. Cut and mining method means, extracted area is filled with broken rocks.

**Maximum Slope Change**

Under this project no surface excavations are carried out. Instead, underground mining is taken place by developing shafts, adits. Hence, no surface excavations creating slope changes taken place under this project.

**[MAHINDA SHOULD ADD HERE WITH REGARDS TO WATERBODIES ETC]**

#### **2.4.1.10. Mine Drainage Water Management Details**

#### **2.4.1.11. Ventilation System for Adequate Control of Quality and Quantity of Air Underground**

Since the mine has two shafts and three adits, natural ventilation will prevail. However, a 24 inches Axial-flow ventilation fan will be installed. With the progress of mining, air quality measurements need to be done and number of ventilation of fans increased accordingly.

#### **2.4.1.12. Details Related to Blasting (Diameter, Depth of Bore Holes, No. of Bore Holes and Blasting & Explosives to be Used)**

Proposed excavations for further deeper and lateral development should be carried out only after conducting a theodolite mine survey and immediately followed by linking the adit to the main system. Linking of the adit to the main openings serves the purpose of;

- Establishing the essential emergency exit.
- Creating the possible main haulage way from the lower levels, saving on energy in hoisting.
- Main mine drainage outlet.

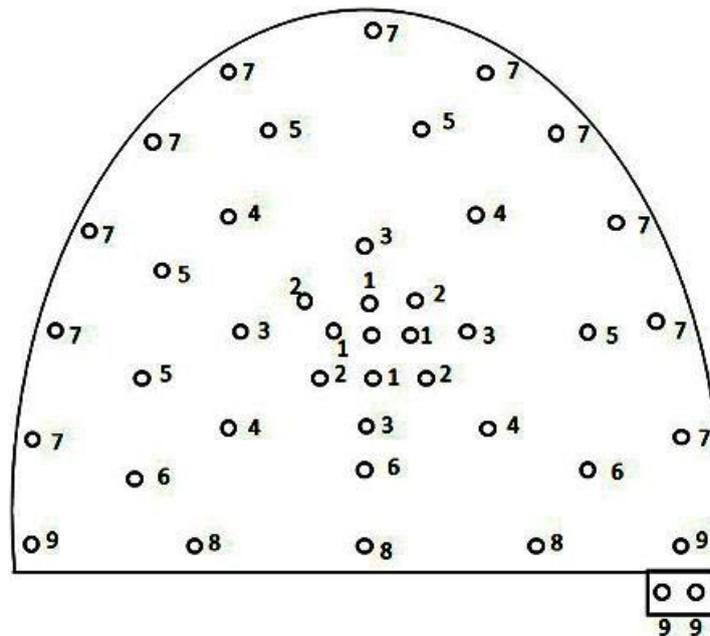
Further development is recommended to be continued with the lateral excavation of horizontal drifts along the vein from the point of intersection at the mini pit bottom. After drifting 20-30 meters laterally, winzes should be excavated along the dip of the vein. Both drifting and winzing enable the measurements of vein widths, an essential input in establishing the proven category of reserves. Winzes sunk to a 30-40 m. depth linked at the lower level forming a block of graphite with known vein widths at all four sides creating a **block of proven resources**. This will serve as bed rock for future mine planning.

With regard to the dimensions of the drifts, they should be excavated with adequate cross sectional area for wagon haulage and also ensuring the safety feature of enabling and average person to walk erectly. Adequate drift cross sections provide sufficient space for the services such as service pipe laying and ventilation tubing. A standard cross-section of 2.2 x 2.1 m<sup>2</sup> is recommended with roof cap support of

either timber or second-hand rails. Drift side support should be considered location-wise. Development excavations are done by drilling-and-blasting.

➤ **Tunnel (Cross-cut) Excavation:**

Cross-section recommended is 2.2 x 2.1 m<sup>2</sup>. Drilling configuration and the charging pattern are shown in Figure 2.5 below.



**Figure - 2.4.1.12:** Tunnel section showing the drilling pattern and the blasting sequence

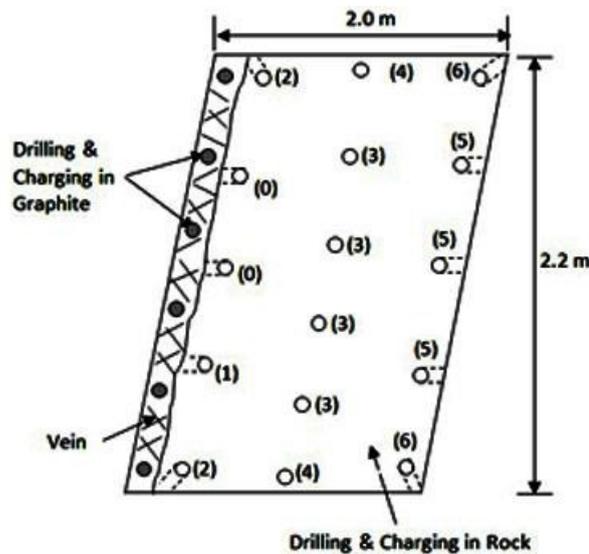
**Table - 2.4.1.12:** Drill-Blast details for tunnels (cross cuts)

Type of Rock	Garnetiferous quartzofeldspathic gneiss (Ref. RS Mines Exploration Report)
Tunnel Cross section	2.2 X 2.1 m <sup>2</sup> (before lining)
Cut-hole round	Burn-cut
Max. drilling depth	1.5 m
Drill hole diameter	32 mm
Blasting sequence – Cut-holes	Half-second
Blasting – reliefs, roof holes, trimmers, and the bottom holes	Milli-second
Explosives - Primer	Water-gel / Emulsion- 22/28 X 200 mm
Explosive- Rest of the holes	ANFO in cartridge form
Method of initiation	Electric initiation

➤ **Drift excavation:**

Drilling and the blast pattern of the drift is shown in Figure 2.4.1.12(a) below. Exposed graphite vein is subjected to cautious blasting to ensure minimum formation of dust that will lead to losses. Blasting should be conducted to ensure minimum dilution as this will determine the value of the final product. Blasting of the rock part of the face will follow the extraction of the vein. Blast pattern may be varied depending on the face specifics such as the fracture pattern, graphite mineralization etc. As the vein width of vein type graphite occurrences is characterized by high variability, drifting should continue to a distance decided by the geologist. Face mucking should be carried out taking extreme care to maximize recovery and minimize dilution.

Roof support constitutes placing a timber or second-hand rail cap with board lagging. Side wall rock bolting should be carried out depending on the stability of the hanging wall and the foot wall.



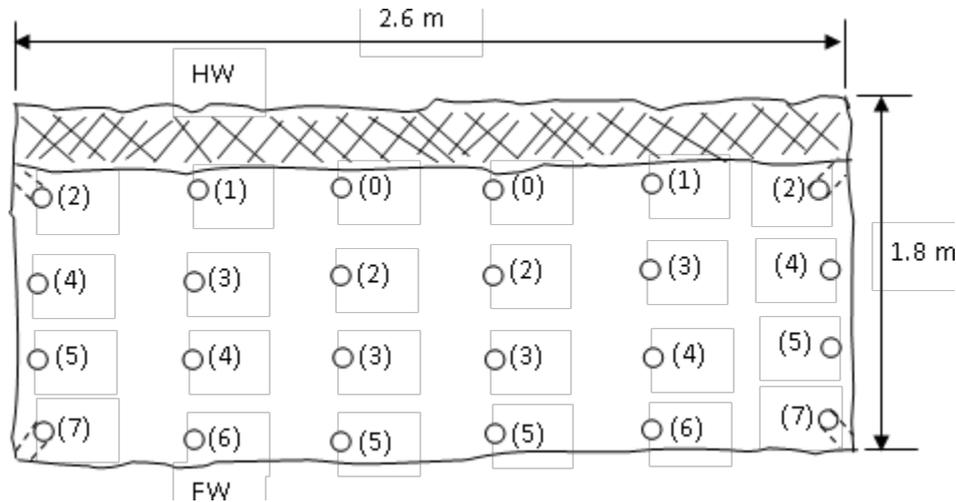
**Figure - 2.4.1.12(a):** Drift-Drill and Blast pattern

**Table 2.4.1.12(a):** Drill and blast details of the drift

Type of Rock	Garnetiferous quartzofeldspathic gneiss (Ref. RS Mines Exploration Report)
Drift cross section	2.2 X 2.1 m <sup>2</sup>
Max. drilling depth	0.9 m
Drill hole diameter	32 mm
Blasting sequence	Graphite vein extraction by light blasting should be followed by blasting rock.
Explosives	Water-gel / Emulsion- 22/28 X 200 mm primer and ANFO in cartridge form
Method of initiation	Electric initiation

➤ **Winze excavation**

Typical drilling and blast pattern of a winze is shown in Figure 2.4.1.12(b). The exposed vein should be subjected to light blasting ensuring minimum dilution and maximum recovery. After removal of the extracted graphite the rock part of the vein should be blasted. Proposed firing order is shown in the Figure 2.4.1.12(b).



**Figure 2.4.1.12(b): Winze-Drill and Blast pattern**

**Table 2.4.1.12(b): Drill and blast details of the winze**

Type of Rock	Garnetiferous quartzofeldspathic gneiss (Ref. RS Mines Exploration Report)
Winze cross section	2.6 X 1.8 m <sup>2</sup>
Max. drilling depth	0.9 m
Drill hole diameter	32 mm
Blasting sequence	Graphite vein extraction by light blasting should be followed by blasting rock.
Explosives	Water-gel / Emulsion- 22/28 X 200 mm primer and ANFO in cartridge form
Method of initiation	Electric initiation

➤ **Shaft Excavation:**

The major development is seen as the shaft excavation beyond the current depth. Shaft is rectangular section and of sectional dimensions are 4.0 X 2.5 m<sup>2</sup>. Plan and the sectional views are shown in Figure 2.8 below.

The Cut-hole Round constitutes a Wedge-Cut. Maxim8m drilling depth per round is recommended 0.9 m. Firing pattern of the total round is shown below.

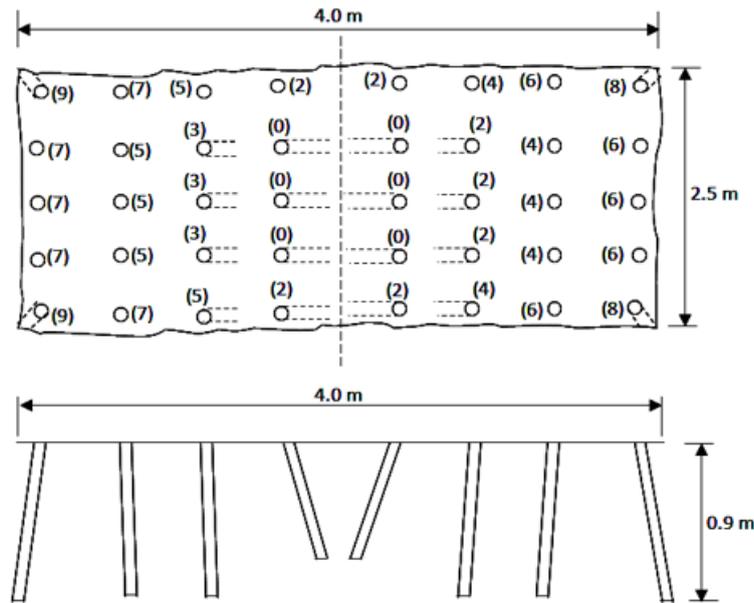


Figure - 2.4.1.12(c): Winze plan view and sectionalized view

Table 2.4.1.12(c): Drill and blast details of the shaft

Type of Rock	Garnetiferous quartzofeldspathic gneiss (Ref. RS Mines Exploration Report)
Shaft cross section	4.0 X 2.5 m <sup>2</sup>
Max. drilling depth	0.9 m
Drill hole diameter	32 mm
Blasting sequence – Cut hole round	Wedge cut and the adjacent rows are blasted with half-second delays and the rest of the round using milli-second delays
Explosives	Water-gel / Emulsion- 22/28 X 200 mm primer and ANFO in cartridge form
Method of initiation	Electric initiation

### 2.4.1.13. Rate of Mining and Life Time of the Deposit

Production forecast break-down over the years is shown in Table - 2.4.1.13 below. In parallel with the production operations, it is highly recommended to continue the on-going exploration drilling and development to convert predicted 53,131 tons to inferred resource to prolong the mine service life to ensure the maximum recovery of the graphite resource of 106,047 tons.

Particular attention of the management is drawn to build-up the work force including recruitment of qualified technical staff and training of the cadre.

As rock breaking being a major activity, all operating underground workmen should be given a special training in handling and usage of explosives. A designated officer with adequate technical knowledge should handle all records relating to explosive movements.

**Table - 2.4.1.13:** Production forecast break-down over the years

Years	Activity	Annual Average Production Forecast (Tonnes)
0-1	Fixing/ Support, Services, Mine surveying, Adit clearance, Mucking, Hoisting, Operative training, Expansion of service workshop, Man-power build-up.	nil
1-2	Fixing/ Support, Services, Mine surveying, Mucking, Hoisting, Operative training, Drilling and Blasting operations, Start-up production	up to 1000
2-3	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities, Operative training,	up to 1250
3-4	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities, Operative training,	up to 1500
4-5	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities,	up to 1750
5-6	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 2000
6-7	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 3000
7-8	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 4000
8-9	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 5000
10-11	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 6000
11-12	Fixing/ Support, Services, Drilling and Blasting,	up to 7000

	Stoping and related activity, Loading, Hoisting and related activities.	
12-13	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 8000
13-14	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 9000
14-15	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 10000
15-16	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 11000
16-20	Fixing/ Support, Services, Drilling and Blasting, Stoping and related activity, Loading, Hoisting and related activities.	up to 36029
<b>0-20</b>	<b>Total Graphite Production</b>	<b>106,047</b>

The volume estimated above for level up to 150m, however with the progress of mining further underground exploration will be conducted. It may find further deep extension of graphite veins and hence mine may go deeper than presently planned. However, up to the present estimate up to 150m level, mine will operate for 20 years.

#### **2.4.1.14. Any Requirement of Supporting Materials**

##### **Shaft**

A framework made up of G-I pipes with locked joints in place put up guarding the shaft with timber board lagging only serves as support for vertical loads. This support is not capable of taking up any horizontal loads. It is observed that about 20 m. thickness of soil cover and the encountered rock is highly weathered requiring concrete support for any possible lateral loading manifesting as a result of rock blasting concussions.

##### **Adit:**

Existing adit is recommended to be linked to the main system. As it is in highly weathered rock and will serve as a useful section for dewatering and transport of graphite out, support including portal concreting should be given serious consideration. Rock bolts need to be installed where blocks of rocks are liable to come down.

### **Other Mine Openings**

Mine openings developed in the close vicinity of the bottom of the main shaft, namely short pits and drifts are in highly weathered rock and unsupported. All the drift need to be supported with rock bolt where applicable and in general with timber logs.

#### **2.4.1.15. Water Requirement and Waste Water Generation from Various Activities of Mine**

### **2.4.2 Proposed Stockpiling / Storage**

Under this project, two stockpiling sites are proposed to stockpile and storage of mined graphite (Sites – A & B in Fig. 2.4.2) (Site – A near the office and Site – B near the entrance of mine). In addition, another 3 sites are proposed for following purposes.

- to separate graphite lumps from blasted rock fragments by manual chipping (Site – C in Fig. 2.4.2)
- to keep graphite veins bearing rock fragments until graphite lumps are separated by manual chipping at Site – C (Site – D in Fig. 2.4.2)
- to dump waste rocks and to dispose soil materials accumulated during development of mine structure (Site – E in Fig. 2.4.2)

#### **2.4.2.1. Locations of Stockpiling / Storage**

Locations of stockpiling / storage sites are shown in Fig. 2.4.2.

#### **2.4.2.2. Height and Area Required**

##### **Mine Graphite Storage Site (Site – A in Fig. 2.4.2)**

It is expected to storage mine graphite in 50kg bags at this site until they are transported to processing site for further processing. Area of the storage site is 10m x 5m and it is expected to store graphite bearing bags up to 4m height at this site.

##### **Mined Graphite Stockpiling Site (Site – B in Fig. 2.4.2)**

It is expected to stockpile mined graphite for about 3m height at the proposed site. Its area is 271m<sup>2</sup>.

##### **Site to Separate Graphite Lumps from Blasted Rock Fragments by Manual Chipping (Site – C in Fig. 2.4.2)**

It is expected to maintain a site to separate graphite lumps from the blasted rock fragments. Its area is 162m<sup>2</sup>.

##### **Site to Keep Graphite Veins Bearing Rock Fragments until Graphite are Separated by Manual Chipping at Site - C (Site – D in Fig. 2.4.2)**

It is expected to maintain a site to keep graphite veins bearing rock fragments until graphite lumps are separated from the blasted rock fragments. Its area is 162m<sup>2</sup>.

##### **Dumping Site for Waste Rocks and Soil Materials Accumulated during Development of Mine Structure (Site – E in Fig. 2.4.2)**

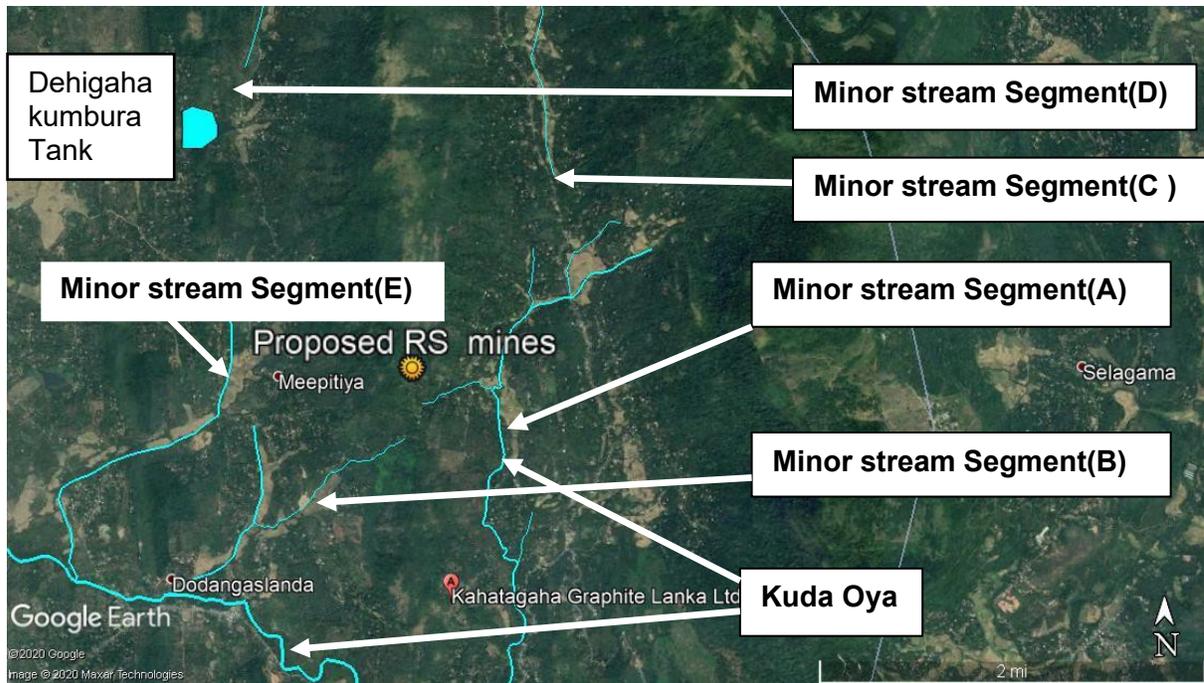
It is expected to dump waste rocks and soil materials accumulated during the development of mine structure for about 5m height at this site. Its area is 1,117m<sup>2</sup>.

#### **2.4.2.3. Proposed Drainage Management Plan**

Proposed Drainage Management Plan is shown in Figure – 2.4.2.3. In order to manage the rain water and wastewater generating from various activities of the mine, a built-up drain system will be erected along the slope boundary and middle of the ridge slope of the project site as shown in Fig. – 2.4.2.3. It is expected to erect about 10 silt traps within the built-up drainage system in order to control siltation related issues. Drained water through the built-up drain system and through the 10 silt traps will be further drained into the Kuda Oya stream. Finally, water in the project land and its immediate surrounding will be drained into the Deduru Oya through the Kuda Oya (Fig. 2.4.2.3A).

Drainage Management Plan covering the project site and its immediate surrounding is shown in Figure – 2.4.2.3.

### Fig. 2.4.2.3: Drainage Management Plan



**Figure – 2.4.2.3A:** Location map showing surface water bodies in and around the study area

### **2.4.3. Separation / Sorting of Graphite**

#### **2.4.3.1. Details Relevant to Separation / Sorting Graphite to be Provided**

During blasting, some graphite fragments will be totally separated out from the country rocks. Such pure graphite fragments will be initially stockpile in the mine graphite stockpiling site, located near the mine entrance (Site – B of Fig. 2.4.2.3).

Some of the graphite lumps brought up may have rocks attached to them. They are initially stockpile in Site – D, until graphite fragments are separated out by manual chipping at Site - C. After separating out graphite fragments by manual chipping, they are put into Site – B for stockpiling.

Then pure separated out graphite will be put into 50kg bags and taken into the graphite storage site (Site – A), located near the office for storage until they are transported to the proposed processing site in Kurunegala Distance between the Site – A and Site – B is about 400m (Fig. 2.4.2.3).

After graphite fragments are separated out from the rocks, waste rocks will be dumped into the waste rocks dumping site (Site – D).

### **2.4.4. Transportation Plan of Material Extracted**

Sorted out graphite will be transported to Processing plant established in Madipola, Matale, in 2 ton trucks.

Monthly transport will be about 50 tons up to 5 years and reach 100 tons after 7 years and 200 tons a month after 10 years. 200 tons per month means about 8 tons a day for 25 days. It will need 4 trucks a day to leave the site.

#### **2.4.4.1. Roads to be Used for Transportation including Gravel Roads, Pradeshiya Sabha Roads, etc,**

Roads usage during transportation are as follows.

1. From the mine entrance, about 400m long private gravel road, owned by the project proponent, exists to the office.

2. From the office, after reaching about 700m distance along the Welanruppa road (Pradeshiya Sabha road), Kotuhena Junction is identified.
3. From the Kotuhena Junction, about 1.3km distance exists to the Maduragoda Junction, along another Pradeshiya Sabha road.
4. Maduragoda Junction is located at 12.3km post of the Kurunegala (Ibbagamuwa) – Matale main road which is administered by Road Development Authority (RDA). From the Maduragoda Junction, all access roads leading to the processing site at Kurunegala are administrated by RDA.

#### **2.4.5. Processing Activities / Value Addition**

There are no processing activities within the mining site. At the mining site, initially only the mined out graphite fragments will be sorted out and keep in the Mined graphite stockpiling site. Then these graphite fragments will be put into 50kg bags and transported to the storage site, located near the office. From there, transported to Processing plant established in Madipola, Matale.

#### **2.4.5.3. Details of Machineries to be Used (Type, HP Rating, No. of Units)**

Basic machinery and equipment required at the commencement of production activity is listed out below. With the ramping-up of production over the years with proper mine planning and design, appropriate equipment will be acquired, and existing machinery and equipment will be replaced. One of the major investments at the start of production will be a suitable electric hoist enabling cage hoisting through the main shaft.

Type	Capacity	Initial Quantity
Generator	250 kVA	01 No.
Drill machine with integral leg drill		04 No.
Compressor	100 kW	01 No.
Axial-flow ventilation fan	4" Dia	01 No.
Blasting Ohm meter		01 Nos.
Exploder / Shot firer		01 Nos.

Gas meter for oxygen, combustible gases		01 No
Vane anemometer		02 No
Compressed air –operated hoists – for winze hoisting	01 mt. capacity	03 Nos
Site utility vehicle to be used as an ambulance. (At all times stationed at the worksite when men are at underground work)		01 Nos
Kibbles – Bottom dumping	500 Kg	06 nos.
Trolley chassis and bins		6-7 Nos.
Hoist certified for men hoisting (Within the first year)	5 tonnes, 440V	01 No
Track rails (24-inch gauge)		Adequate stock of lengths
GI pipe – 1-inch, ½ –inch diameter		Adequate stock of lengths
Plasma cutter/ Steel cutting tool		02 No
Submersible pumps (Depending on the water inflow)		03 Nos
Lightening conductor		01 No
Suitable wire rope lengths for 02-03mt hoisting capacity with adequate safety factor.		

Basic consumables constitute timber logs, drill bits, planks, chisels, SH rails, hammers ventilation ducting, hand saws, shovels, pans, rock bolts, Plasma cutter/ Steel cutting tool Hitches, tamping rods, blow pipes, bull-dog clips, basic workshop tools, PPE equipment, wire ropes for winze hoisting, required tools for mining, mechanical and electrical repairs.

#### **2.4.6. Noise / Vibration Control Strategies**

##### **2.4.6.1. Noise / Vibration Levels**

Noise levels are governed primarily by the noisiest piece of equipment used, rock drilling and waste rock material handling. Normally drilling is being done in underground and therefore the noise generated from the drilling will not be blown

to the surface level. It will only affect to the underground miners. Expected noise level in  $L_{Aeq,T}$  due to drilling activities may increase up to around 80 to 115 dB(A).

Limited machinery and vehicle will be employed for the project due to the expecting low scale of the project.

Noise on the surface will be mainly due to generator and compressor. Generator is necessary to operate the hoist. There are no settlements within 200m radius from the project site. Hence, no measurable noise at the nearest residence due to operating the compressor or generator. Since over 10 months have been working for the clearance and renovation of adits and shafts, there has not been any complains from the residents.

But those machines do not generate much noise. Therefore, only during the time of material transportation will generate noise, but not continuous due to somewhat low production rate of the mine.

The project site and its boundary are within the Ridigama Pradeshiya Sabha area. Therefore, according to the national Environmental (Noise Control) regulation No.1 of 1996, Extraordinary Gazette No 924/12, 1996, Maximum permissible noise levels at boundaries in  $L_{AeqT}$  of the project area in Day time and Nighttime are 55 dB(A) and 45 dB(A) with, respectively.

Residential areas are mainly scattered more than 200m in S and SE directions from the main shaft. Therefore, the noise level for the residential area will be below to 55 dB(A).

Main source for the ground vibration of this site is underground blasting for Mine development. Houses are scatted more than 200m from the initially developed main shaft. Vibration level for these structures will be kept below the maximum permissible limit of 5mm/sec according to the interim standards for vibration control stipulated by CEA.

Noise and vibrations measured during the test blast is given in Annex – 2.4.6

It shows that noise level and vibration level is below CEA recommended levels.

### **2.4.6.2 Control Strategies**

#### **Noise**

Expected noise level in  $L_{Aeq,T}$  due to drilling activities may increase up to around 80 to 115 dB(A). This would cause workers in the mine exposed to high noise levels. World Health Organization (WHO) has set 85 dB as their maximum exposure limit in the workplace. Above this level, hearing protection will be worn. Therefore, ear plug will be provided for all underground workers.

Special control strategies will not be applied to control noise generated due to limited machinery and vehicles usage for the site activities. Also, the stationary machines are driven by electric power and are silent. However, every possible attempt will be taken to minimize the generated noise from the limited machinery and vehicles being used, by keeping those in good working order.

Compressor will be kept in prime condition to create least amount of noise. Since there are no dwellings or important structures within 200m from the site, noise will not be felt particularly because there is well grown vegetation cover around the site.

No work will be carried at nighttime which makes noise over 45 dB. Also, the surrounding vegetation cover acts as a natural noise barrier to the site, and therefore it will not be disturbed.

#### **Vibration**

Explosive type and weight, delay-timing variations, size, and number of holes, bore hole pattern, distance between holes and rows (Spacing and Burden), method and direction of blast initiation, Distance from blast to point of concern (house, tank, etc.), geology and overburden are the main factors which affect ground vibrations from rock blasting.

The distance from the blast to the point of concern cannot be controlled. But other parameters can be controlled. Therefore, proper blasting with controlling every possible aspect to minimize the ground vibration will be designed with the consultancy of GSMB and CEA. All the restrictions and limitations enforced by CEA, GSMB or any other regulating authority will strictly be followed, ensuring the environment friendly nature of the project.

Also, every blast will be carried only under the supervision of qualified Mining Engineers with relevant experience.

## **2.4.7 Air Emission Control System**

### **2.4.7.1. Air Emission points**

According to a former worker who is living around the abandoned mine complex, mining activities in main Queens mine at Kotuhena village was conducted in early nineties. This currently abandoned mine was located within the Mipitiyakanda (also known as Minirankanda) ridge structure. Two vertical shafts and three adits were identified in this mine and were located on the middle of about 400m high Mipitiyakanda ridge structure. In addition, number of abandoned shallow shafts and combined shaft & adit structures could also be identified within 300m radius of the proposed mine structure within the Minirankanda ridge.

According to the former worker, about 6 inches to 1.5 feet thick good quality needle type semi-crystalline graphite veins were observed within this mine at different levels. He further mentioned that considerable amount of economically viable graphite could be mined from the remaining parts of the vein system in this mine if the mining activities are in proper manner. In addition, substantial amount of graphite could also be mined by extending the mining activities further down in the abandoned surrounding shallow pits.

By considering these facts, the management of R S Mines (Pvt) Ltd. had conducted cleaning of main mine complex (with 2 shafts and 3 adits) during the exploration stage.

Following safety plan related to air emissions was used during cleaning procedure of the main mine complex.

- Ventilation system, including ventilation fans (exhaust and blower) and ductings were installed to increase the air quality of the mine.
- Checking for any Hazardous gases (CO, CO<sub>2</sub>, SO<sub>2</sub>, LEL gases, etc.) and level of oxygen in working areas within the cleared adit / shaft structures using Multi Gas Detector.
- Oxygen canisters were introduced and given instructions to the labourers about the procedure to use them.

Presence of noxious gases or shortage of oxygen can be expected when re-commencement of mine in this old location. So, it is necessary to extend checking of all noxious gases are removed and the presence of oxygen concentration when the re-commencement of mine.

Mining is supposed to carry out for further depth. Therefore, cleaned old shafts will have to be developed for further depth. For that drilling and blasting will be required. Also, the drilling and blasting will be applied when development of drives, ore passes, manways, winzes, ventilation rises and underground mine development. Gases like  $\text{NO}_x$ ,  $\text{CO}$ ,  $\text{CO}_2$  mainly get into atmosphere together with dust during rock blasting, but drilling does not emit dust to the atmosphere because wet drilling is normally applied for underground operations.

Only manual methods will be applied for the underground mucking and loading process, no machines will be used for that. Therefore, gases being released from underground machines will not be applicable. But air may be contaminated by dust due to mucking and loading.

Few machines and vehicles are used for site purpose i.e., Generator, cab and jeep, dump truck/light truck. During operation of diesel or petrol driven above machinery and vehicles, due to imperfect combustion, few amount of  $\text{CO}$ ,  $\text{SO}_2$ , oxides of Nitrogen ( $\text{NO}_x$ ) would be released to the atmosphere.

Maintenance of access road and internal service roads, material transportation, handling of mine waste and waste rock dumping yard are other main sources for dust generation. This would be more significant during dry weather condition.

#### **2.4.7.2 Emissions Control System**

Mining is supposed to carry out for further depth. Therefore, cleaned old shafts may be developed further deeper. Therefore, noxious gases such as methane and hydrogen sulfide may be encountered when the mine is opened. Also, the shortage of oxygen can be happen in this old opening. Therefore, proper mechanical ventilation has to be provided to the opening and check all noxious gases are removed from that area with the present oxygen content.

Proper fan forced ventilation system which is developed and improved with the progress of mine, use to provide a continuous supply of fresh air to the working faces in the mine. This ventilation system augments the natural ventilation and

gives adequate fresh air and dilute toxic gases like NO<sub>x</sub>, CO, CO<sub>2</sub>, and extract and/or dilute dust generate from the blasting. Also helps to control temperature and humidity of the mine for miners.

The broken materials are watered down after blasting and before starting the mucking and loading to minimize dust due to blasting, mucking, and loading activities. Also, wet drilling technique is applied to prevent dust emission from the underground drilling.

Other identified dust generating locations in surface are access road, internal service roads and waste rock dumping area. Those will be suppressed by water to minimize dust emission.

Gases being released from machines and vehicles will be at minimum because small number of diesel or petrol driven machines and vehicles are used for the project works. Therefore, those gases will be immediately dilute in to the environment. However, all are kept in good condition to maintain gas emission at acceptable levels.

Existing vegetation cover of surrounding area, which provides a good filtering mode for CO<sub>2</sub> and to control of dust emission, will not be disturbed. Unnecessary removal of trees and vegetation in surrounding areas will be avoided.

#### **2.4.7.3. Plans to Reduce or Control Emissions**

##### **Mine Ventilation System**

Proper underground mechanical ventilation system will;

- Provide a continuous supply of fresh air.
- Dilute, render harmless and remove unwanted gases.
- Extract and/or dilute dust.
- Control temperature and humidity.

The ventilation procedures shall include relevant aspects of the mining regulations, workplace exposure standards and other relevant legislation. The development and improvement of the mine ventilation system will be done according to the international standards. But the maximum permissible limits for some gases are specified by the national air quality standard by CEA. Therefore

for the workplace exposure standards for gases follow both national and international standards as required.

At the initial stage, clearing of old adit and shaft structures was done with the help of one ventilation blower (750 W) and ductings, mine ventilation had been provided.

Presently, main areas of the mine (2 shafts and 3 adits) below the surface level are separately ventilated by 2 ventilation blowers (each 750 W, 82 cu.m/min) which mounted at the surface level.

With the future development, one of the suitable old pits or adits will be set up as a ventilation shaft or tunnel by installing adequate capacity main ventilation blower (about 50 kW, 600 cu.m/min)) at there. Currently, surface mounted ventilation blowers provide fresh air to underground via air ducts.

In future construction of ventilation walls, doors and installation of underground booster fans will streamline the ventilation network in underground.

Mining Engineer of the company will develop the ventilation system. Normally the current ventilation model shall be reviewed and updated at least once a year or before a major ventilation change, to ensure that the model reflects what is happening at the site. This shall occur by the following:

- a) Carrying out a pressure/quantity survey at each area/major air districts (splits);
- b) Carrying out a pressure/quantity survey within each area/ section and panels;
- c) Inputting the updated data
- d) Verification of the model

Any major change to the ventilation system will be modelled prior to the change being implemented. This is to ensure that the modelling will confirm the effect of the change on all ventilation splits in the site and that all relevant standards can be maintained.

Relevant design changes to develop the current ventilation system will be done by adding booster fans, Doors, Regulators, Ventilation stoppings, Overcasts/ Underpasses, Screens and flaps, Seals as necessarily.

The following inspections shall be carried out and recorded at least twice per shift.

They shall:

- Ensure there are no gas accumulations within the work area.
- Ensure that adequate ventilation is being supplied to the working place ( $4\text{m}^3/\text{sec}$ ) by measuring the air velocity by the use of manometer (Air Flow Rate = Air Volume x Area)
- Ensure the monitoring & recording of levels of gases. Also, that those are within the required safety levels in the working place. Work crews are to have a digital gas detector with them at all times while working underground.
- Ensure no recirculation is occurring from the auxiliary ventilation set-up.
- Check that humidity and temperature are within acceptable standards.
- Inspect other working areas of the site official's jurisdiction
- Monitor the main fan(s) and auxiliary fan (s).

### **Wet Drilling**

The type of drill is usually a jackhammer type machine mounted on an airleg. All holes are collared with water, so the dust does not contaminate the atmosphere. An in-line oiler is connected in between the machine and the hose and injects oil into the machine by pulsing of the air to keep it lubricated. The water for the wet drilling will come from dewatering the mine (Fig.2.4.7.3 & Fig.2.4.7.3A)

### **Watering procedure**

Water spraying will be used to prevent dust emission from both underground and surface operations of the project. Blasting of faces, mucking, and loading will mainly generate dust from underground. Therefore, after blasting and before starting mucking and loading, water will be sprayed, to broken material.

Access road, internal service roads and waste material dumping areas will be suppressed with water at least three times a day only in the dry season.

The water for the drilling machines and dust suppression for underground operations, will be pumped from mine dewatering to a header tank. From the tank the water will be pumped along the tunnel via 50 mm steel / PVC pipes (Fig.2.4.7.3 & Fig.2.4.7.3A). These pipes will be hung on the side walls and will have outlet taps at regular intervals. The same water from mine dewatering will be used for the surface dust controlling. A water bowser will be used for that.

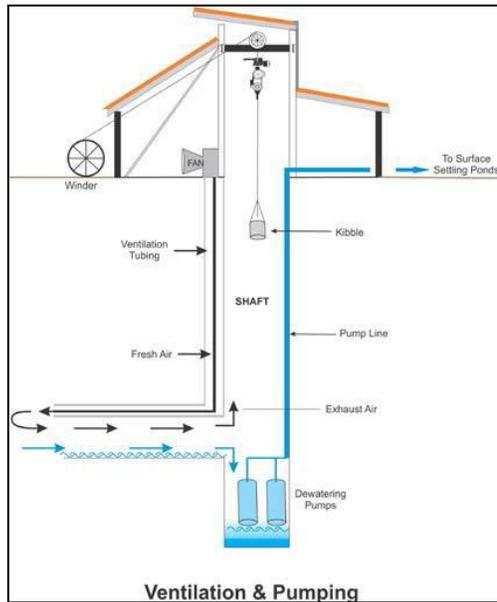


Fig. - 2.4.4.3

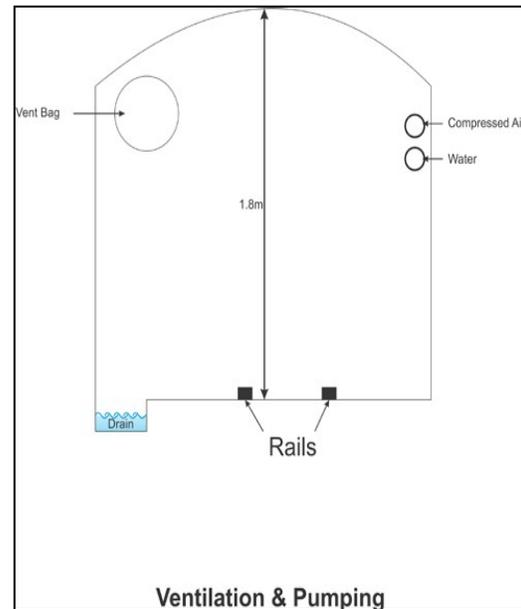


Fig. - 2.4.4.3A

**Figures - 2.4.4.3 & 2.4.4.3A:** Ventilation and pumping system going to be developed

## 2.4.8 Soil Erosion Control Measures

During the rainy season, there is a possibility to observe soil erosion from the exposed sections of the upper hill slope of main mine area and its surrounding. To control soil erosion from these sections, all soil exposed sections will be grass turfed and built up drain system will be erected covering the slope area covering the mine and its surrounding (Fig. 2.4.8). Total of 10 silt traps will be erected as shown in the Drainage Management Plan in order to control siltation related issues within the mine area (Fig. 2.4.8). These silt traps will be periodically cleaned to ensure sufficient capacity for collection of any future silt materials, especially during rainy season.

In addition, contour drainages will also be developed within the ridge slopes surrounding the mine complex, as shown in the drainage management plan (Fig. 2.4.8).

Furthermore, drainage paths will be developed as per the guidelines given by the NBRO by their report (Annex – 2.4.8).

### **Tailings Accumulated from Mine**

Under this project, two stockpiling sites are proposed to stockpile and storage of mined graphite (Sites – A & B in Fig. 2.4.2) (Site – A near the office and Site – B near the entrance of mine). In addition, another 3 sites are proposed for following purposes.

- to separate graphite lumps from blasted rock fragments by manual chipping (Site – C in Fig. 2.4.2)
- to keep graphite veins bearing rock fragments until graphite are separated by manual chipping at Site – C (Site – D in Fig. 2.4.2)
- to dump waste rocks and to dispose soil materials accumulated during development of existing adit structure (Site – E in Fig. 2.4.2)

Except for bagged graphite storage site, all the other sites are located in front of the mine entrance. The bagged graphite storage site is located in about 400m away from the mine entrance at close proximity to the project office.

During rainy season, there is a possibility to wash off the finer materials from these sites and encounter soil erosion and siltation related issues. But, since built-up drainage system is proposed covering the entire project area together with 10 silt traps and contour based earth drainage pattern, these wash off finer materials will be drained along the built-up drainage paths, contour based earth drainage paths and trap within the 10 silt traps. Hence, soil erosion and siltation related issues from the hill slope covering the project area could be controlled.

It is necessary to clean up the trapped silt materials from the silt traps regularly, especially during the rainy season.

Drainage Management Plan covering the project site and its immediate surrounding is shown in Figure – 2.4.8.

## **Fig. 2.4.8 - Drainage Management Plan**

#### **2.4.9. Materials Required for Rehabilitation**

Cut and fill method will be applied during the graphite mining process at the proposed Kotuhena mine complex. After a blast, pure graphite fragments and graphite bearing rock fragments are collected and are hoisted to the surface. Separated graphite fragments will be stockpiled within the mined graphite stockpiling site. Waste rock fragments accumulated at the ground surface, after graphite is separated out, will be dumped systematically in the waste rocks dumping site without allowing falling.

Since the cut and fill method will be applied in the mine, after a blast, graphite free blasted out rock fragments are filled in the blasted out additional void space, keeping adequate space to extend the mining activities along the adit structure.

When mining project is completed, only unfilled area left, will be shaft, tunnels, and drives. Tunnels and drives are well secured with timber, concrete struts together with rock bolts.

After completing mining activities, the mine opening will be completely sealed using steel plates and steel plates will be locked. This is done to facilitate reopening of the mine in future by any interested party when the graphite prices increase. Like many old graphite mines are reopened today, this mine also may be reopened to recover low grade graphite. Therefore, it is not prudent to close tunnels, drives and shaft completely. Whereas mine mouth is closed to prevent people and animals entering into it. In addition, main mine area will also be barricaded with a permanent fence.

When extending the adit structure/s, if any adit structure/s are connected to ground surface during mining activities, such adit opening/s will also be sealed with steel plates and barricaded with permanent fence.

Therefore, additional soil / rock materials are not needed for mined pit rehabilitation process.

### **2.5 Work Force**

#### **2.5.1 a. Labour Requirement**

Initial manpower requirement is given in Table – 2.5.

Mine Management will decide on increasing the manpower input depending on Mining Program and the related Production Plan.

For specific tasks of temporary nature, Management may decide on contract labour and outsourcing the job.

**Table – 2.5: Initial Manpower Requirement**

<b>Work Force</b>	
<b>Designation</b>	<b>Qty</b>
Mine manager/Mining Engineer	01
Accountant	01
Accounts & Personnel clerk	02
Underground Mine supervisor	02
Mine Foreman - Mechanical	01
Qualified electrician	01
Mechanic	02
Miners-Skilled	08
Miners- Unskilled to be trained (Preferably with previous underground experience)	20
Clerk/Storekeeper	01
Driver	02
<b>Total</b>	<b>41</b>

**2.5.1b. Employment of Local People during Site Preparation and Operation**

**2.5.1c. Availability of Labour in the Area**

Out of the total required work force, half would be unskilled trainee workers.

**Existing occupation pattern in the study area**

It was important to study the employment pattern in the area to identify their principle economic activities and social backgrounds. Therefore, the existing occupation pattern is analyzed (Table – 2.5.1b).

**Table 2.5.1b: Occupation Pattern**

Type of occupation	Number of HHH	%
Famer	03	17
Skilled labour	04	22
Unskilled labour	08	45
Government & private sector jobs	01	05
Business /Self-employment and other	02	11
<b>Total</b>	<b>18</b>	<b>100</b>

Source- Household survey, Kotuhena, March 2020

Above the table indicates that the majority of inhabitants living in the area are engaged in unskilled and skilled labor activities (67%). They do not have a monthly fixed income and depend on day to day job opportunities. During the study, it was realized that the demand for jobs in the new project is extremely high. Then the second important category of the occupation is farmers. These farmers are engaged in the cultivation of coconut, betel, and paddy, etc. The other important job categories are business and self-employment. These details indicate that the project has an opportunity to find the workers from the surrounding areas.

### **Project Preparation Period**

Considerable number of employment opportunities will be created during the period of the project preparation, especially in shaft grounding, Land escaping, construction of parapets, buildings, roads, stockpiles, and other required structures. Through these employment opportunities the local people and the migratory workers will be benefitted as well.

### **Project Operation Period**

According to the development plan of the proposed graphite mining project, about 41 workers would be required as direct workers (both males and females) to engage in related work. Besides, indirect job opportunities and income avenues will be created through this project when it is in the operation stage. During the project is in operation both male and female laborer inputs will be needed. Based on the nature of the operational activities of the proposed project, it could be summarized the division of laborer in both males and females (Table – 2.5.1c).

**Table.2.5.1c: Division of Labour**

<b>Nature of work</b>	<b>Division of laborer by gender</b>
Underground mining and transportation	Males
Transport from mining point to the initial screening point	Males
initial screening	Females
Storing	Both males and females
Manual transportation	Both males and females
Vehicle transportation	Males
Final screening and storing	Females

Source- Household survey, Kotuhena, March 2020

The above discussion shows the distribution of laborer among both males and females during the project is in operations. And also surrounding communities will be benefited through these new employment opportunities. However, the project should prepare a selection criterion with giving reasonable weight to required skilled and unskilled laborers within the surrounding villages for future recruitment of labor as well. Then the system of new requirements should be transparent to the people. If so, it can avoid conflict between the project and the surrounding settlers and on the other hand supports the operation of the project.

Hence, in this regard, a systematic employment program will be organized with the assistance of Ridigama Divisional Secretariat and Kotuhena Village Development Society to award entire unskilled category employment opportunities to the Kotuhena and surrounding villagers in a proper manner. During the field survey of the IEE study it was noted that enough local people are available in the area for recruiting for labourers.

**2.5.1 d. Occupational Health and Safety Facilities Required / Provided**

- **Sanitation:** Portable toilets may be placed underground as the mine gets deeper and ablutions will be available on the surface. Suitable areas for crews to wash prior to meals and at the completion of shift will be provided. Undercover areas suitable for crews to have meals will be provided.
- **Security:** There will be a security station at the front entrance gate. Operations will be manned 24 hours, 7 days per week. This will stop

unauthorised people from entering the mine site, which includes the underground mine. Mining activities are planned for a single shift operation however may become 2 x 8 hour shifts at some point in the future.

- **Safety:** R.S Mines Pvt. Ltd. has been operating in Sri Lanka for more than 5 year period during its exploration program and has a best practice approach to the safety and wellbeing of its workforce and contractors. Extensive safety training is ongoing, and every task undertaken must have a Standard Operating Procedure (SOP) and Job Hazard Assessment(JHA) completed and approved prior to undertaking that duty. All R S Mines employees undertake a full medical check-up prior to employment and obtain a First Aid Certificate. It is a requirement that all personnel and contractors are inducted trained, educated and understand the procedures which apply in all operating areas of the mine site. It is vital to the rapid response and positive handling of any situation that personnel have a clear understanding of what is required and more importantly, of what they in particular must do. No matter at which level they may be involved, their response and contribution could be vital to saving lives, minimising injury, and suffering, and reducing damage, if they know what to do and can do it correctly. All R S Mines employees and contractors undergo regular toolbox and safety refresher meetings to ensure the best practice policies and SOP are understood and adopted.
- **Emergency Treatment:** Emergency treatment will be at the mine site first aid facility. The operation will have a comprehensive first aid kit / trauma kit with instructions for shock and injury. The First Aid facility will also have splints, bandages, and instructions for handling broken bones. The First Aid Officer will have been instructed to see what will be done for shock, puncture wounds, head injuries, severe bleeding, broken bones, snake bites, burns, electric shock, dislocated joints, and heat strokes as well as other first aid instructions. High lift stretcher facilities will be available for the emergency recovery of personnel, regular safety training on the recovery / treatment of injured personnel will be carried out and assessed by the R S Mines safety officer.

A suitable well maintained vehicle will be on location at all times during mining operations. R S Mines Pvt Ltd. will have access to local medical practitioners in the case of emergency.

- **Types of Emergencies:** Fire - bush fire, equipment fire. Flooding – roads, inrush. Service disruption – water, electricity supply. Accidental explosion. Chemical spill or contamination. Vehicle accident. Equipment or Plant Injury. Confined space injury. Falls from Height. Natural disaster cyclone, storm etc. Gas presence. Electrocution. Collapse of workings.

**Health and Safety Facilities Required / Provided**

<b>Sanitary, Safety &amp; Housing</b>	
Training on safety	will be provided
Notice and signboards about safety	will be provided
Annual medical tests	will be provided
Standby vehicle for emergency	will be provided
Sanitary facilities	will be provided
Accommodation for workers	will be provided

**2.5.1e. Insurance Cover**

An insurance cover is a basic requirement when applying for the Industrial Mining License (IML) to cover compensation of workers' safety. Insurance cover for all officers and workers (total of 30 workers), who are employed in the mine, will be obtained.

**2.6. Details of Instantaneous Mass of Charge**

**2.6.1 a. If safety fuse and Blasting Powder / Detonator are Intended to be Used**

**2.6.1b. If Electrical / Chemical Detonator are Intended to be Used.**

**Blasting Parameters and Blast Design**  
**Explosive / Chemical Storage**  
**Transport of Explosives**

## **2.7. Other Facilities Required / Provided by the Project**

### **2.7.1. Vehicle Parking**

Area for vehicle parking has been reserved within the project area, near the office. In this park, about 2-3 double cabs, 2 Tractors and 2 two-cube lorries could be parked at a given time. The area reserved for vehicle parking is shown in Project Layout Plan (Fig. 2.4.2).

### **2.7.2. Fire Protection Facilities**

Suitable dry powder fire extinguishers will be placed on all levels of operations. Fire extinguishers will be placed near all electrical boxes, compressors, generators and ventilation fans. Fire extinguishers will be strategically placed on plats and levels and all employees and contractors will be trained in the use and care of the fire suppression provided. These will be used to prevent grass fires from coming too close to the mine entrances.

### **2.7.3. Other Infrastructure Facilities Required**

The Kotuhena mine site layout is planned to encompass all necessary transportable buildings to provide the workforce with suitable safety, ablutions, messing and equipment storage. The site will be constructed with the environment in mind with the planned use of renewable energy sources using solar panels and battery storage to minimize the energy footprint of the mine. At the same time, the use of battery power to run dewatering pumps and fans during non-production times will minimize any noise pollution on the surrounding environment. The site is designed to have a small footprint and no processing will occur on site with produced graphite being transported to a central processing facility which is to be established in Madipola, Matale.

## **2.8. Details of Machinery to be Used in the Mining Activities and the Processing Activities and their Types, Horsepower Ratings, Number of Units**

Basic machinery and equipment required at the commencement of production activity is listed out below. With the ramping-up of production over the years with proper mine planning and design, appropriate equipment will be acquired, and existing machinery and equipment will be replaced. One of the major investments

at the start of production will be a suitable electric hoist enabling cage hoisting through the main shaft.

Type	Capacity	Initial Quantity
Generator	250 kVA	01 No.
Drill machine with integral leg drill		04 No.
Compressor	100 kW	01 No.
Axial-flow ventilation fan	4" Dia	01 No.
Blasting Ohm meter		01 Nos.
Exploder / Shot firer		01 Nos.
Gas meter for oxygen, combustible gases		01 No
Vane anemometer		02 No
Compressed air –operated hoists – for winze hoisting	01 mt. capacity	03 Nos
Site utility vehicle to be used as an ambulance. (At all times stationed at the worksite when men are at underground work)		01 Nos
Kibbles – Bottom dumping	500 Kg	06 nos.
Trolley chassis and bins		6-7 Nos.
Hoist certified for men hoisting (Within the first year)	5 tonnes, 440V	01 No
Track rails (24-inch gauge)		Adequate stock of lengths
GI pipe – 1-inch, ½ –inch diameter		Adequate stock of lengths
Plasma cutter/ Steel cutting tool		02 No
Submersible pumps (Depending on the water inflow)		03 Nos
Lightening conductor		01 No
Suitable wire rope lengths for 02-03mt hoisting capacity with adequate safety factor.		

Basic consumables constitute timber logs, drill bits, planks, chisels, SH rails, hammers ventilation ducting, hand saws, shovels, pans, rock bolts, Plasma

cutter/ Steel cutting tool Hitches, tamping rods, blow pipes, bull-dog clips, basic workshop tools, PPE equipment, wire ropes for winze hoisting, required tools for mining, mechanical and electrical repairs.

**2.9. Transportation of Machinery, Equipment and Products  
 (Routs, Frequency and Type of Vehicles to be Used)**

**2.10. Details of Qualities and Quantities of Fuel Used, Water Requirements and Other Resources Requirements**

**2.11. Time Schedule Including Phased Out Development / Implementation Plan**

Activity	PROJECTED DEVELOPMENT & PRODUCTION SCHEDULE																			
	Year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Development of old shaft, tunnels, drifts	█																			
Develop Stope block 1, produce		█																		
Develop stope blocks 2, 3, produce			█	█																
Develop stope blocks 4,5,6, produce					█	█	█													
Develop stope blocks 7,8,9, produce								█	█	█	█									
Develop stope blocks 10,11,12, produce												█	█	█						
Develop stope blocks 13,14,15 produce															█	█	█			
Develop stope blocks 7,8,9, produce																		█	█	
Restoration of the mine																				█

## **2.12. Future Expansions Expected**

Future expansions of the graphite mine are depended on the occurrence and extension of graphite veins at deeper levels and the commercial aspects of graphite prices.

## **CHAPTER - 3**

### **DESCRIPTION OF THE EXISTING ENVIRONMENT**

#### **3.1 Geological Conditions**

##### **3.1.1 Physical Features**

###### **3.1.1.1 Topography**

Physiographically, the area covered by the proposed project and its surrounding belongs to middle peneplain of Sri Lanka. The relief of the area around project site varies from 300 – 633m a.m.s.l, (Figures – 3.1.1.1 & 3.1.1.1A). Presence of ridge and valley topography is a characteristic feature encountered in and around the project area (Figures – 3.1.1.1 & 3.1.1.1A and Plate – 3.1.1.1). The proposed mine is situated on the E directed downward slope of the N-S trending ridge structure (Plate – 3.1.1.1A).



**Plate – 3.1.1.1**



**Plate – 3.1.1.1A**

**Plate – 3.1.1.1:** Presence of ridge and valley topography in and around the project area

**Plate – 3.1.1.1A:** Proposed mine is situated on the E directed downward slope of the N-S trending ridge structure

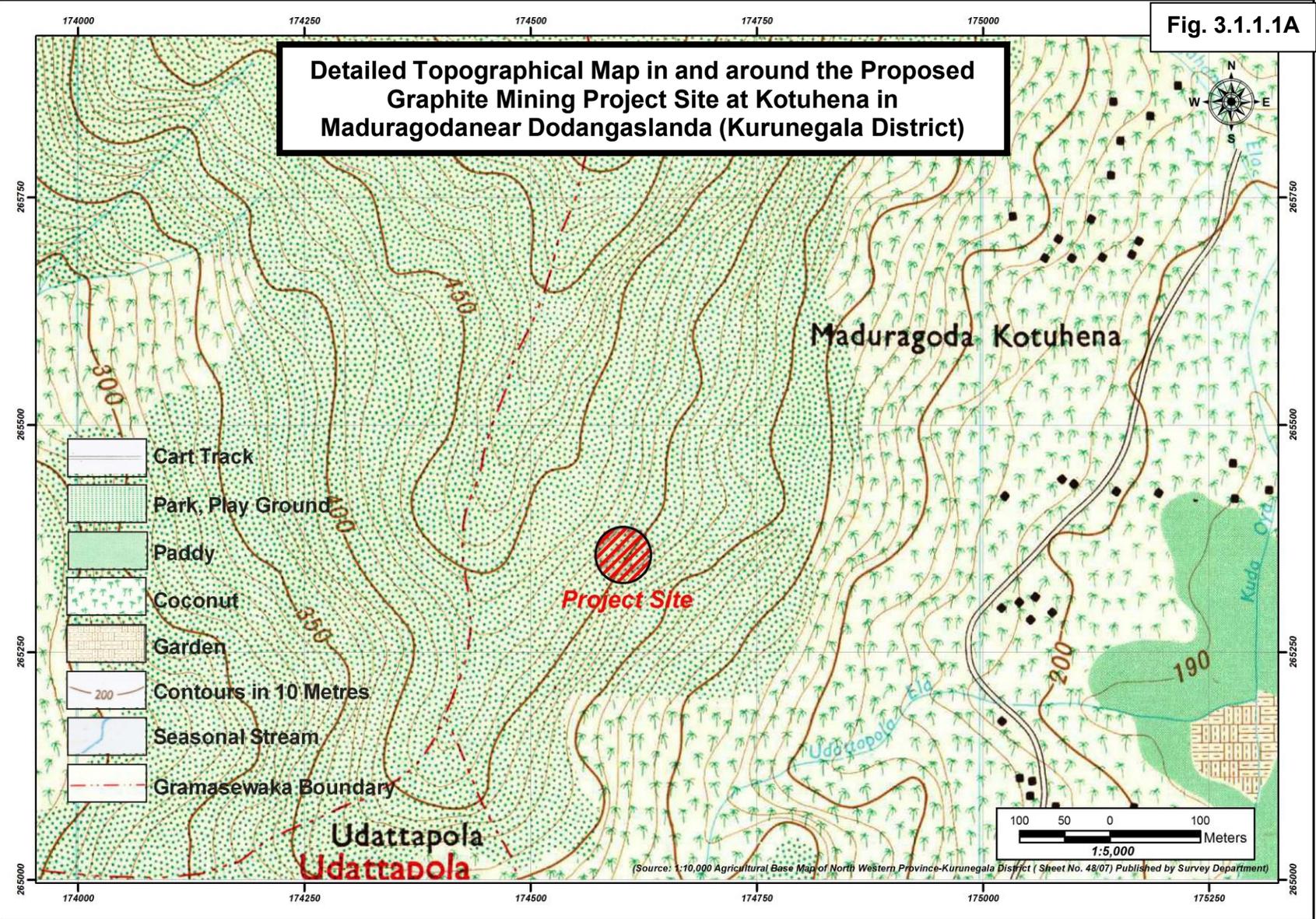
Dodangaslanda region could be considered as an undulated ridge and valley province. The relief within a short distance varies substantially resulting in a great diversity of physiographic features within a comparatively small area. It is noted that several valleys are developed at the study area mainly along NS direction (strike valleys).

During the exploration activities, full topographic survey and leveling, covering the Kotuhena project site was conducted (Plate – 3.1.1.1B and Fig. 3.1.1.1B). During this topographic survey, important structures such as old workings have also been demarcated.



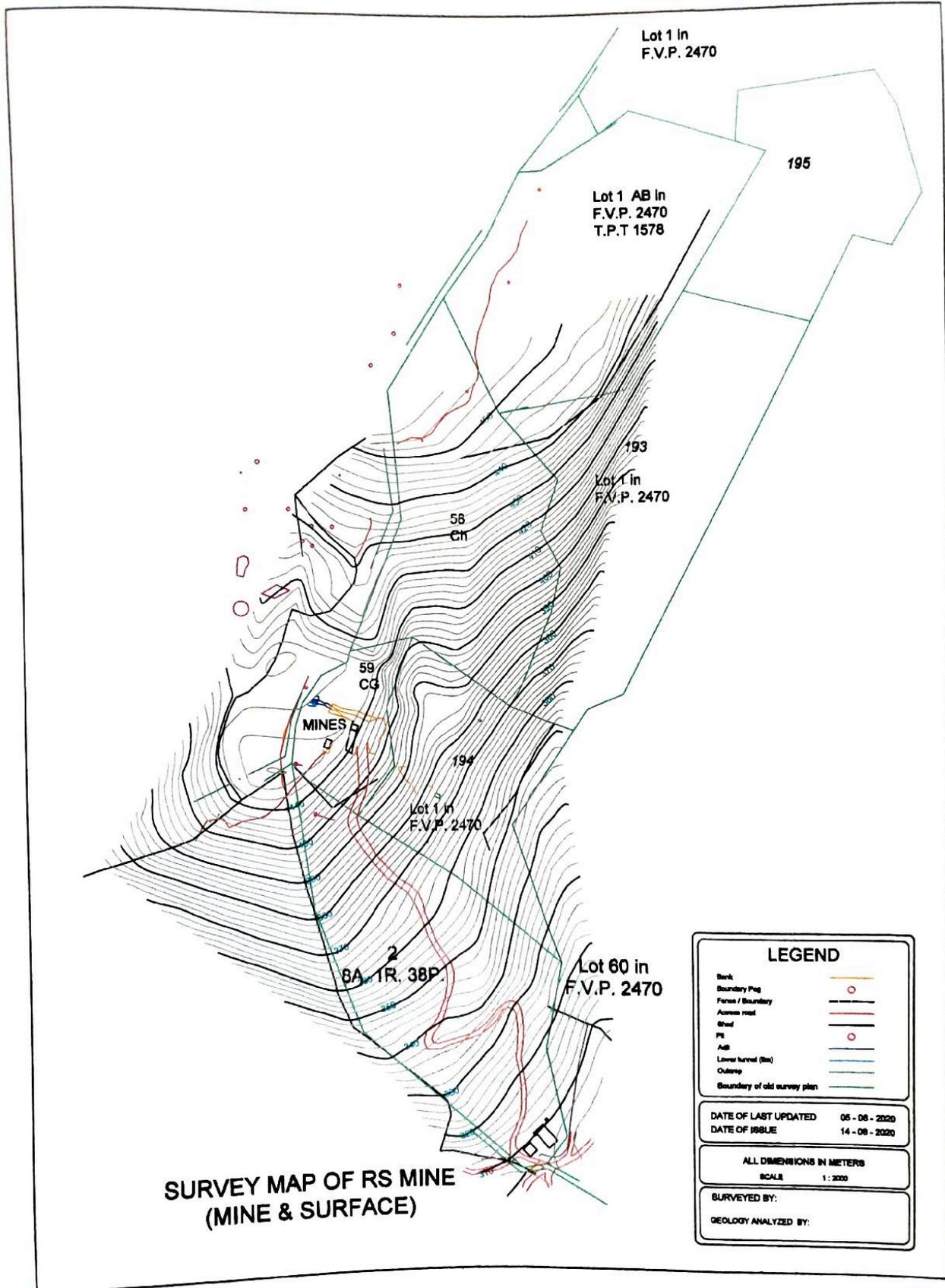
Fig. 3.1.1.1A

Detailed Topographical Map in and around the Proposed Graphite Mining Project Site at Kotuhena in Maduragodanear Dodangaslanda (Kurunegala District)



(Source: 1:10,000 Agricultural Base Map of North Western Province-Kurunegala District (Sheet No. 48/07) Published by Survey Department)

Fig. 3.1.1.1B: Contour Map Prepared by Surveying





**Plate 3.1.1.1B:** Conducting topographic survey covering the project site at Kotuhena

The availability of water in the study area varies throughout the year and is controlled by the existing climatic conditions. The rain fall, runoff, land use, soil and geology, and evapotranspiration are the most important factors for the availability of the surface water in the study area. The average annual rain fall of the area is more than 2000 mm.

### **3.1.1.2. Vegetation**

Undisturbed natural habitats are not found in the project site. The major habitats found in the project area are coconut plantations, home gardens and secondary degraded vegetation, in the surroundings and paddy fields in the valleys. The vegetation found in the proposed mine area is secondary due to the degradation of natural vegetation. Plant species such as *Trema orientalis* (Gedumba), *Macaranga peltata* (Kenda), *Caryota urens* (Kitul) and *Alstonia macrophylla* (Hawari Nuga), are found in the area.

### **Flora of the Project Area**

A total of 49 plant species and 36 indigenous species were recorded during the field survey within the study area (Table - 3.1.1.2). Twelve plant species recorded at the study area are exotic and naturalized species which indicates that the area is disturbed due to human influence. All recorded flora species are not unique or restricted to the project area.

**Table 3.1.1.2:** Summary of the plant species recorded during the study

No of Species	Endemic Species	Nationally Threatened	Exotic Species
49	0	01	12

**Threatened and Endemic Flora**

A trees species recorded at the project site considered as a threatened plant (Karaw) according to the Red list 2012. Endemic plant species were not recorded at the project site. (Table – 3.1.1.2A).

**Table 3.1.1.2A:** Threatened plant species recorded from the project area.

Family	Species	Local Name	HA	TS	CS
Phyllanthaceae	<i>Magaritaria indica</i>	Karaw	T	N	VU
Cercopithecidae	<i>Macaca sinica</i>	Sri Lanka toque monkey (Rilawa)		E	

**Abbreviations:** HA – Habit, T – Tree, S – Shrub; TS- Taxonomic status, N- Indigenous, E- Endemic, CS- Conservation Status, VU- Vulnerable

**3.1.1.3. Hydrology**

**3.1.1.3.1 Hydrogeology and Aquifer Characteristics of the Area**

Hydrogeologically, three types of water bearing formations could be identified in the study area around proposed RS graphite mining site. They are alluvial deposit, lower part of overburden, and fractured rock formation.

**Alluvial formation:** Alluvial unconsolidated formations are mainly associated with Kuda Oya in riverbanks and old river paths. The clayey sand and sand formation in alluvial deposit below water level of Kuda Oya are water bearing and acts as an unconfined aquifer. The groundwater level of the unconfined alluvial aquifer and its fluctuation totally depend on the water level of the Kuda Oya and groundwater of unconfined alluvial aquifer is mainly replenished from the Kuda Oya.

The several shallow bore holes have been constructed on the alluvial bed along the Kuda Oya for Dodangaslanda water supply scheme (about 3 km away from Proposed RS graphite mine) and these data revealed that average transmissivity of the aquifer bed is about 70-90 m<sup>2</sup>/day.

**Overburden:** The overburden of the study area consists of topsoil, weathered formation (completely to slightly), and colluvium formation. All geological layers could not be seen in one location. It was noted that topsoil and weathered formation are common layers in the overburden in many parts of the study area. The colluvium formation is limited to the old landslide terrains.

It was noted that lower part of the overburden in some places in the area close to the valleys, depressions on the slope, and breaking slopes of the study area are water bearing and acts as unconfined aquifer in seasonal and perennial nature. The available groundwater in lower part of overburden in hilly area flows to the low elevated areas until adding to groundwater table or as oozing through interface between rock and lower part of the overburden along the depressions. Groundwater oozing condition could be seen in some places (two-three places) along the pathway of minor stream (A) at upstream and downstream areas of minor road of Maduragoda - Kotuhena. The total discharging quantity of minor stream (A) is about less than 10 liter/minute during the investigation period. The groundwater within the lower part of overburden of the area is replenished from the rain mainly through direct infiltration of rainwater.

The proposed graphite mining site, all stockpiling sites, and project office are located at the top part of the hillock. Therefore, occurrence of groundwater within the overburden in proposed graphite mining site could not be expected.

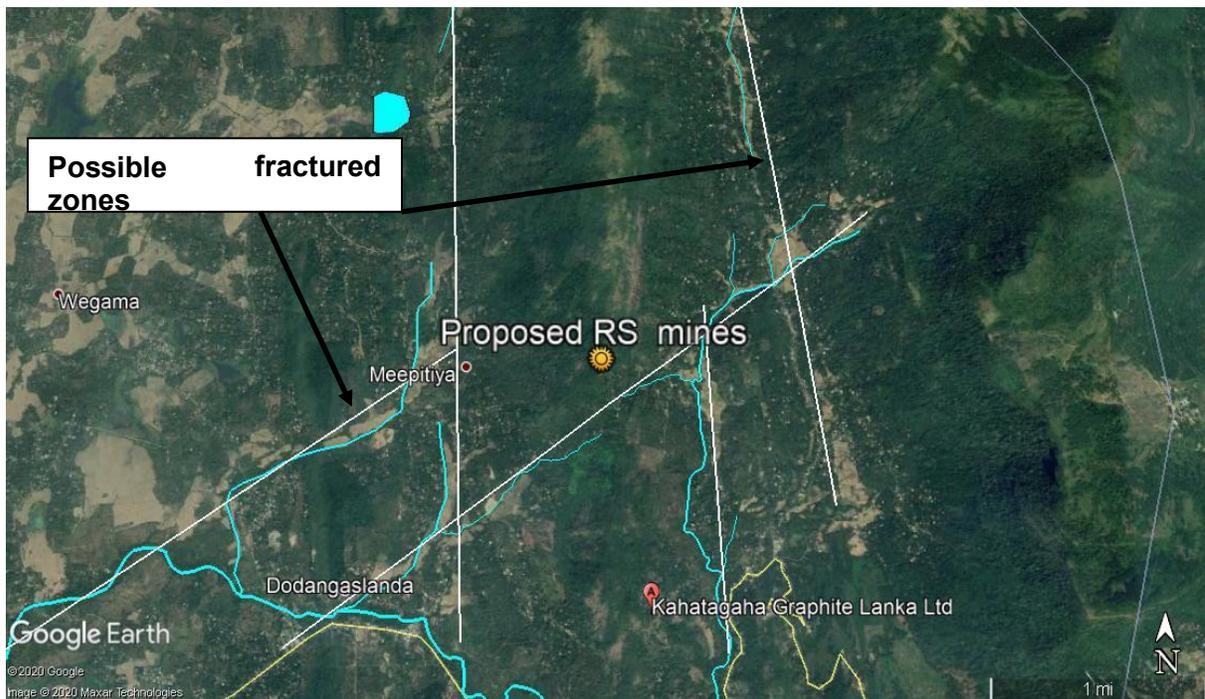
During the investigation period, water bearing conditions of the some dug wells were assessed. The recovery and aquifer conditions of the dug wells located at the area close to Kuda Oya are good with compared to the dug wells located on the hilly and slope area. Therefore, dug wells located on the slope of study area could not, suitable to use for large groundwater extractions.

**Fractured rock formation:** The water bearing ability of hard rock depend on the presence of fractures, joints, and fissures, and to some extent also on foliation and schistosity planes and cleavage. These features will be produced the secondary porosity and permeability in the crystalline rocks.

According to the structural geological map on satellite image, bed rocks at the study area are fractured along major two directions (Figure: 3.1.1.3.1). One fracture system runs along the direction of N-S parallel to the strike of rock. The direction of other fracture system is NE-SW. Also, structural geological map revealed that main fractured zones are not running through the selected area for

RS graphite mine and existing Kahatagaha graphite mine. According to the information received from project proponent, six exploratory drill holes have done in the area around proposed RS graphite mine for graphite investigations and drilling depth of the bore holes varies from 68 m (335 m mean sea level) to 265 m (135 m mean sea level) below ground level. The drilling data revealed that encountered fractures are not water bearing and most of fractures are tight and filled with graphite.

Hydrogeologically, these water bearing fractured formation acts as semi confined aquifer. The groundwater in these fractured zones is recharged from the rain. During the field, it is noted that one hand pump deep well has been constructed about 500 m away from the proposed RS graphite mining site towards SE direction. This tube well located along the NS oriented fractured zone of the study area has been tested and transmissivity of the fractured formation is about 15m<sup>2</sup>/day.



**Figure - 3.1.1.3.1:** Structural Geological features on satellite image in and around the Proposed RS Graphite Mining Site, Maduragoda, Dodangaslanda

### **3.1.1.3.2 Groundwater Quality. Groundwater Potential of the Area and its Availability. Groundwater Table (Pre Monsoon & Post Monsoon)**

Generally, study area shows ridge and valley topography and located within intermediate climatic zone of Sri Lanka. Therefore, groundwater flow velocity and groundwater replenishment rate in the study area are relatively high with compared to the dry zone of Sri Lanka. It may help to have low enrichment of minerals in the groundwater of the area.

A water sample was collected from the existing dug well (DW1) for the chemical analysis. The measured chemical and physical water quality parameters are summarized in Table - 3.1.1.3.2) and Annex - 3.1.1.3.2).

**Table - 3.1.1.3.2:** Chemical and Physical Water Quality Parameters in Groundwater (DW1)

<b>Parameter</b>	<b>SLS potable water Guidelines (SLS614,2013)</b>	<b>DW1</b>
Colour	15 units	Less than 2.5
Turbidity in NTU	2 NTU	0.4
pH (lab)	7.0 to 8.5	6.8
Electrical conductivity in $\mu\text{s}/\text{cm}$ (lab)	750-3500	380
Total Hardness in mg/l (as $\text{CaCO}_3$ )	250	135
Total Alkalinity in mg/l (as $\text{CaCO}_3$ )	200	125
Total Dissolved solids in mg/L	500	253
Free Ammonia as $\text{NH}_3$	0.06	0.88
Total Iron in mg/l (as Fe)	0.3	0.04
Chloride in mg/l (as Cl)	250	14.9
Fluoride mg/l as F	1.0	0.3
Nitrate mg/l as $\text{NO}_3$	50	Less than 0.5
Nitride mg/l as $\text{NO}_2$	3	Less than 0.007
Sulphate in mg/l as $\text{SO}_4$	250	6
Phosphate in mg/l $\text{PO}_4$	2	Less than 0.06

The chemical analysis indicates that all measured water quality parameters except free ammonia are as per the SLS drinking water guidelines. The groundwater mainly occurs in three geological formations such as alluvial

deposit, lower part of the overburden, and fractured formation. The groundwater potential of aquifer mainly depends on the storage capacity and transmissivity of the water bearing formation.

The alluvial formation of the area is associated with Kuda Oya in riverbanks and old river paths. The thickness of the alluvial deposit is about 3-5m. The thickness the aquifer formation at the area close to the project area is about 1-2m and transmissivity of the water bearing formation is about 70-90 m<sup>2</sup>/day. Also, groundwater level of the alluvial deposit and its fluctuation totally depend on the water level of the Kuda Oya. The groundwater of the alluvial deposit is replenished from the Kuda Oya. According to the information collected, discharge rate of the Kuda Oya decreases drastically during the dry period and sometime water in the Kuda Oya occurs as puddle. During the investigation period, discharge rate of the Kuda Oya at the area close to DW10 is 120-150 liters per minute. Therefore, groundwater potential of the alluvial deposit is exceptionally low due to the limited aquifer thickness, limited lateral distribution, and availability of water in the Kuda Oya.

The availability of groundwater at the overburden mainly depends on thickness of the overburden and hydrogeological conditions of the site. The thickness of the overburden varies from place to place with a maximum of 12m and relatively thick overburden could be expected at the area close to the paddy land and Kuda Oya with compared to hilly area and its slope. The proposed RS graphite project site is located at the top part of the hillock and thickness of the overburden is low. Therefore, occurrence of groundwater within the overburden in proposed graphite mining site could not be expected.

Lower part of the overburden in some places in the area close to the valleys, depressions on the slope, and breaking slopes of the study area are water bearing and acts as unconfined aquifer in seasonal and perennial nature.

The available groundwater in lower part of overburden in hilly area flows to the low elevated areas until they added to groundwater table or as oozing through interface between rock and lower part of the overburden along the depressions. Groundwater oozing condition could be seen in some places (two places) along the pathway of minor stream (A) at upstream and downstream areas close to minor road of Maduragoda - Kotuhena. The total discharging quantity is about less than 10 liter/minute during the investigation period (Plate - 3.1.1.3.2).



**Plate - 3.1.1.3.2:** Groundwater oozing area and discharging of groundwater along the minor stream (A) close to the minor road of Maduragoda – Kotuhena, Dodangaslanda.

The field studies revealed that available water column in the dug wells located in hilly and slope area is less than one meter and all the available dug wells in hilly and slope areas are located at the area very closer to minor stream (A) and other minor streams. Also, all visited dug wells in hilly and slope area have dug up to rock level. The occurrence of groundwater in subsurface formations at the area away from the minor streams could not be expected. The available water column in dug wells in hilly and slope area will be further reduced and some of dug wells will get dry during the dry period. The available water column in the dug wells located at the area closer to paddy land and Kuda Oya is more than two meter and recharging conditions of the these dug wells are relatively good with compared to the hilly and slope areas.

The results indicated that groundwater potential in hilly area and areas close to Kuda Oya are different and relatively higher groundwater potential are expected at the area close to the Kuda Oya and paddy lands than hilly and slope areas. The lower part of overburden in these areas is suitable for the construction of large diameter dug wells for extraction of groundwater. It was noted that a large diameter dug well (DW10) has been constructed at the area closer to the paddy land to supply water to the village for drinking purposes and construction of other structures of CBO based village Water Supply Schemes (WSS) is in progressed (Plate - 3.1.1.3.2a).



**Plate - 3.1.1.3.2a:** The constructed large diameter dug well (DW10) and pump house for the proposed CBO based village WSS within Project area in Maduragoda

Groundwater level of the study area varies from place to place and generally it follows the topography of the area and hydrogeological conditions of the well site. It was noted that groundwater level of the dug wells located in oozing area is close to the ground level or overflowing nature. Some of visited dug wells (DW1, DW3, DW11, and DW12) exhibits seasonal nature.

The occurrence of groundwater at the subsurface rock formation depends on the hydrogeological conditions of the study area mainly fracturing intensity and fracture width, connectivity of fracture zones, porosity, and permeability of fracture zones.

According to the interpretation of satellite image, bed rock at the study area is fractured along major two directions (Figure - 3.1.1.3.1) such as N-S and NE-SW. N-S oriented fractured system runs parallel to the strike of the rock. These fracture zones of the study area play a big role for the occurrence of groundwater and graphite within rock formation. Also, section of Kuda Oya and other minor streams (C, D, E) are flowing along the N-S oriented fractured zones. Therefore, N-S oriented fractured zones could be suitable for the groundwater extraction

with compared to the other fractures of the study area. Hydrogeologically, all water bearing fractured formations act as semi-confined aquifer.

Some subsurface geological information is available in existing Kahatagaha Graphite mine and existing hand pump well (TW1). The Kahatagaha Graphite mine and hand pump well (TW1) are located about 2 kilometers and 500m away from the proposed RS Mine site, respectively. It is noted that both mines (Proposed RS Mines and Kahatagaha Graphite Mine) are located within similar structural geological regime and structural geological map of the area indicated that main fractured zones are not running through both mines. According to the information received, present depth of the Kahatagaha Graphite mine is more than 800 m below ground level and still mining is in progressed under dry condition without any groundwater ingressions to the mine. Also, any depletion of water level in dug wells or discharging quantity of the Kuda Oya has been not recorded so far. The proposed RS mines could be expected similar groundwater conditions due to its location and presence of similar structural geological set up of the proposed mining area. Therefore, chances of having hydraulic connection between proposed mine and Kuda Oya could be minimum level.

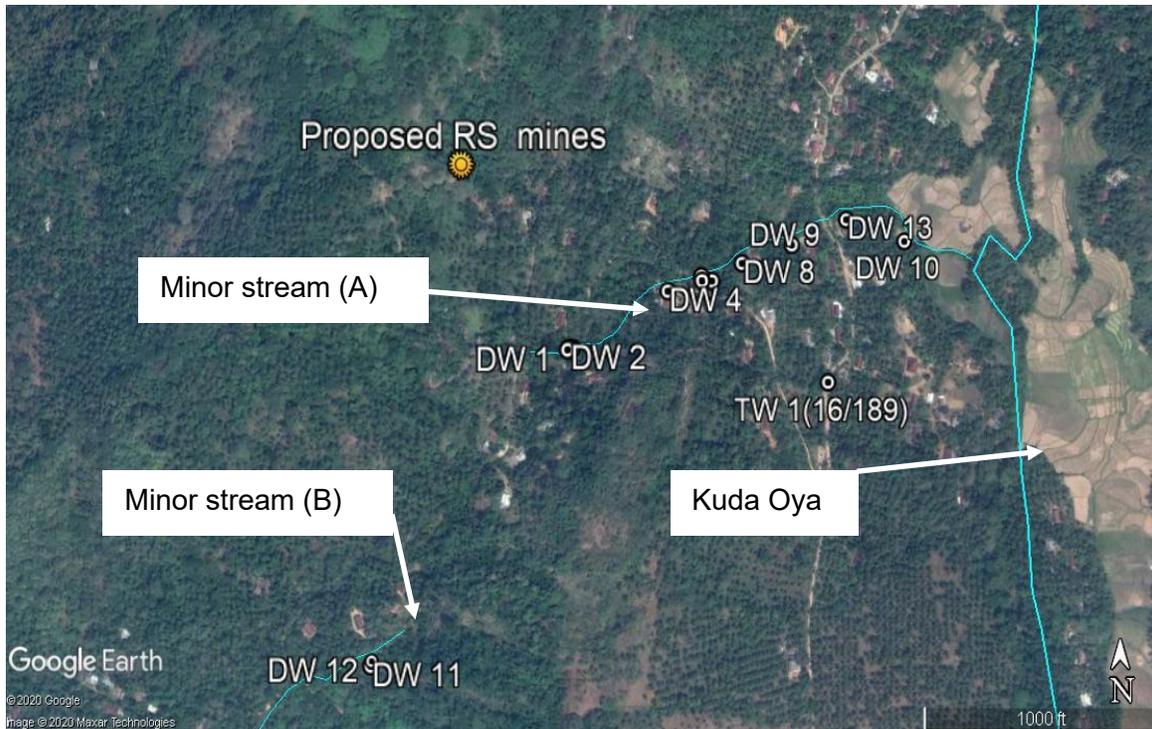
According to the information received, six exploratory drill holes have done in the area around proposed RS graphite mine for graphite investigations. The drilling data (up to 135m mean sea level) revealed that encountered fractures are not water bearing and most of fractures are filled with graphite. However, seepages to the mine structures could be expected from upper subsurface formations mainly during rainy period. The present depth of the RS graphite mine is about 22m and it consists of 2 shafts and 3 adits (some are drives). During the abandoning period of the RS mine (2016 rainy period), groundwater level of the mine (seepage water) has reached to the main adit level (ventilation adit) due to the presence of tight fractures in the mine.

During the field, it is noted that one hand pump deep well has been constructed up to 36m below ground level and it located about 500m away from the proposed graphite mining site towards SE direction. The ground elevation of the proposed RS mine and existing hand pump well is 400m (mean sea level) and 220m (mean sea level) respectively. The water bearing fractures of hand pump tube well have encountered at the depth around 25m and 30m below the ground level and total flushing yield of the well is about 20 l/m.

Several shallow protected and unprotected dug wells are located within study area around proposed graphite mine. The visited wells are shown in Figure - 3.1.1.3.2) and all the available dug wells in hilly and slope areas are located at the area very closer to minor stream (A) and other minor streams. The details of the visited dug wells are given in the Table - 3.1.1.3.2a. The distance to the dug wells of DW1 and DW12 from proposed graphite mine are 220m and 530m, respectively. The photos of visited wells are given in the Plate - 3.1.1.3.2b.



**Plate - 3.1.1.3.2b:** Two visited wells (DW1 and TW1) within the project area, Maduragoda, Dodangaslanda



**Figure - 3.1.1.3.2:** Location map of the visited wells in the study area Maduragoda, Dodangaslanda

**Table - 3.1.1.3.2a:** Details of visited dug wells in the study area, Maduragoda, Dodangaslanda

Well identification number	GPS Coordinates	Well depth (m) -bgl	Standing groundwater level(m) -bgl- 22/3/2020.	Groundwater level in dry period (m)-bgl	Groundwater level in wet period (m)-bgl	Distance from the proposed graphite mine (m)	Remarks
DW1	80 <sup>0</sup> 32'40.19" E 07 <sup>0</sup> 35'21.26" N	1.3	0.2	Dry or less water, seepage water	overflow	220	Partly protected, use for bathing. Dug up to rock level. It is closer to DW 2 and DW 3.
DW2	80 <sup>0</sup> 32'40.26" E 07 <sup>0</sup> 35'21.31" N	2.7	1	2.4 and seepage water	Ground level	220	Protected, use for only drinking. Dug up to rock level. It is closer to DW 1 and DW 3.
DW3	80 <sup>0</sup> 32'40.37" E 07 <sup>0</sup> 35'21.31" N	4.4	3.9	Dry or less water, seepage water	1	220	Unprotected. Use for domestic purposes. Dug up to rock level. It is closer to DW 1 and DW 2.
DW4	80 <sup>0</sup> 32'44.21" E 07 <sup>0</sup> 35'23.46" N	6.4	4.8	6	0.7	270	Protected and use for domestic purposes.
DW5	80 <sup>0</sup> 32'45.63" E	6	5	5	1	300	Unprotected and use for domestic purposes. It is closer

	07° 35'23.88" N						to DW 6. Dug up to rock level.
DW6	80° 32'40.19" E 07° 35'21.26" N	6	5	5	1	300	Unprotected and use for domestic purposes. It is closer to DW 5 . Dug up to rock level.
DW7	80° 32'46.05" E 07° 35'3.89" N	6	5.2	5.6	0.6	340	Protected and not use for any purposes
DW9	80° 32'49.50" E 07° 35'25.35" N	2.1	1.2	1.6	Overflowing	420	Protected and use for drinking and domestic purposes.
DW10	80° 32'54.48" E 07° 35'25.64" N	6.1	0.7	Recently constructed	Overflowing	570	This well is expected to use as intake for the CBO WSS. Not dug up to rock level.
DW11	80° 32'32.39" E 07° 35'10.19" N	2	Dry	Dry	Ground level	530	Protected, located on the path of minor stream (B) and close to DW12. Dug up to bed rock.
DW12	80° 32'32.42" E 07° 35'10.37" N	2.5.	2.2	Dry or sufficient only one family.	Ground level	530	Protected, located on the path of minor stream (B) and closeto DW11. Dug up to bed rock. Use for domestic purposes.

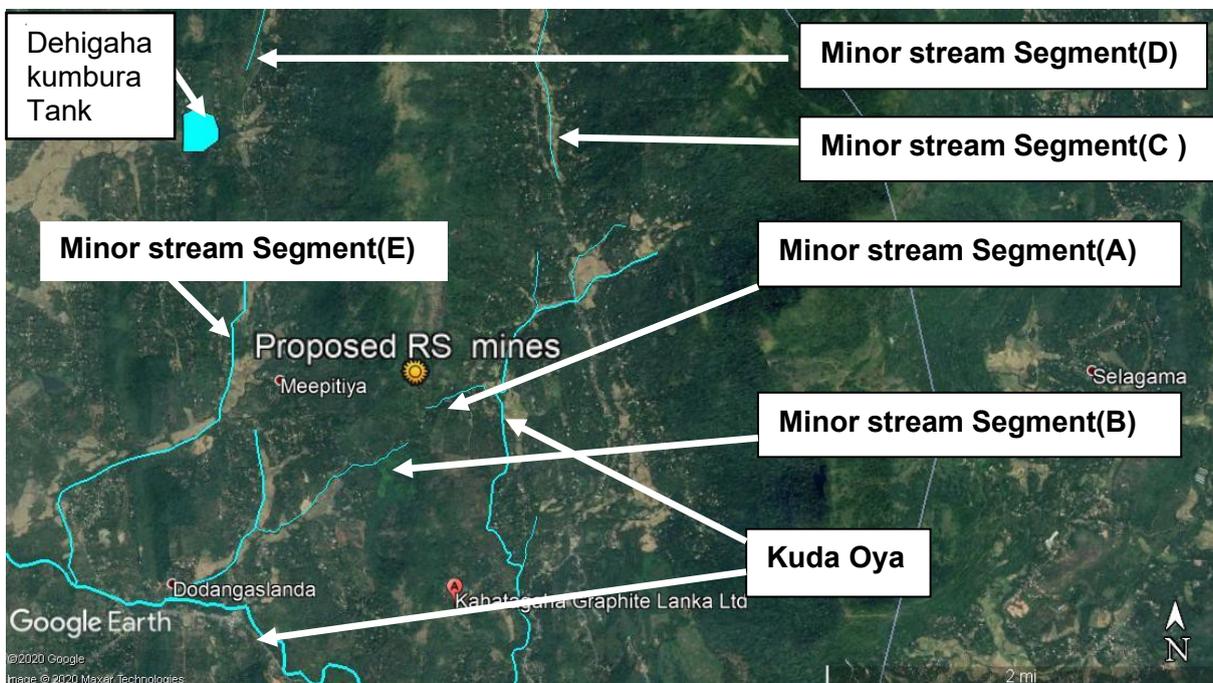
DW13	80 <sup>0</sup> 32'51.93" E 07 <sup>0</sup> 35'26.40" N	2.6	1.2	1.5	0.5	500	Protected, use for drinking purposes. Not dug up to rock level.
TW1 - 16/189	80 <sup>0</sup> 32'50.94" E 07 <sup>0</sup> 35'0.25" N	36				500	Hand pump tube well. Use for drinking and other purposes.

### 3.1.1.3.3 Presence of Surface Water Bodies and Water Quality

The availability of water in the study area varies throughout the year and is controlled by the existing climatic conditions. The rain fall, runoff, land use, soil and geology, and evapotranspiration are the most important factors for the availability of the surface water in the study area. The average annual rain fall of the area is more than 2000 mm.

The perennial water body of the area is Kuda Oya (Plate - 3.1.1.3.3) and discharge rate of the Kuda Oya at the area close to DW 10 is 120-150 liter per minute during the study period. Other available surface water bodies of the study area are seasonal minor streams and seasonal Dehigahakubura minor irrigation tank. All available surface water bodies in the study area are shown in Figure - 3.1.1.3.3. The direct distances from proposed RS graphite mining site to the available water bodies are given below.

Water Body	Distance from RS mining site (m)	Water Body	Distance from RS mining site(m)
Kuda Oya	750	Minor stream(D)	2800
Minor stream(A)	220	Minor stream(E)	1500
Minor stream(B)	400	Dehigahakubura tank	2500
Minor stream(C)	2000		



**Figure - 3.1.1.3.3:** Location map of the surface water bodies at the study area Maduragoda, Dodangaslanda

It is noted that all seasonal minor streams except minor streams (C and D) flow to Kuda Oya. Seasonal minor streams (C and D) flow to Kibulwana Oya. The overland flow of proposed RS mining project site flows to Kuda Oya through seasonal minor streams (A) and (B). The conditions of the seasonal minor stream (A) are given in Plate - 3.1.1.3.3a.



**Plate - 3.1.1.3.3:** Conditions of the Kuda Oya at the area close to the Proposed RS graphite mining site, Maduragoda, Dodangaslanda



**Plate - 3.1.1.3.3a:** Photos of the seasonal minor stream (A) before and after the oozing area

It was noted that several land use types are observed within the study area. The rubber, coconut, home garden vegetation, and scattered bush type vegetation are confined to slope and flat terrain, and paddy fields are mainly at valleys. These plantations play a big role for the rainwater infiltration into ground and part of rain water will be added to the groundwater or seeps to the streams through interface between rock and overburden.

The different types of agrochemicals are used to maintain the plantations and paddy lands to have good harvest. During the rainy period, fraction of agrochemicals and biodegradable contaminants could be added to the streams. The surface water quality of the streams varies temporally and specially. During the study period, a water sample was collected from the Kuda Oya for chemical analysis. The analytical results on the Kuda Oya water are given in Table - 3.1.1.3.3 and Annex - 3.1.1.3.2.

**Table - 3.1.1.3.3:** Chemical and Physical Water Quality Parameters in Kuda Oya close to the Proposed RS graphite mine, Maduragoda, Dodangaslanda

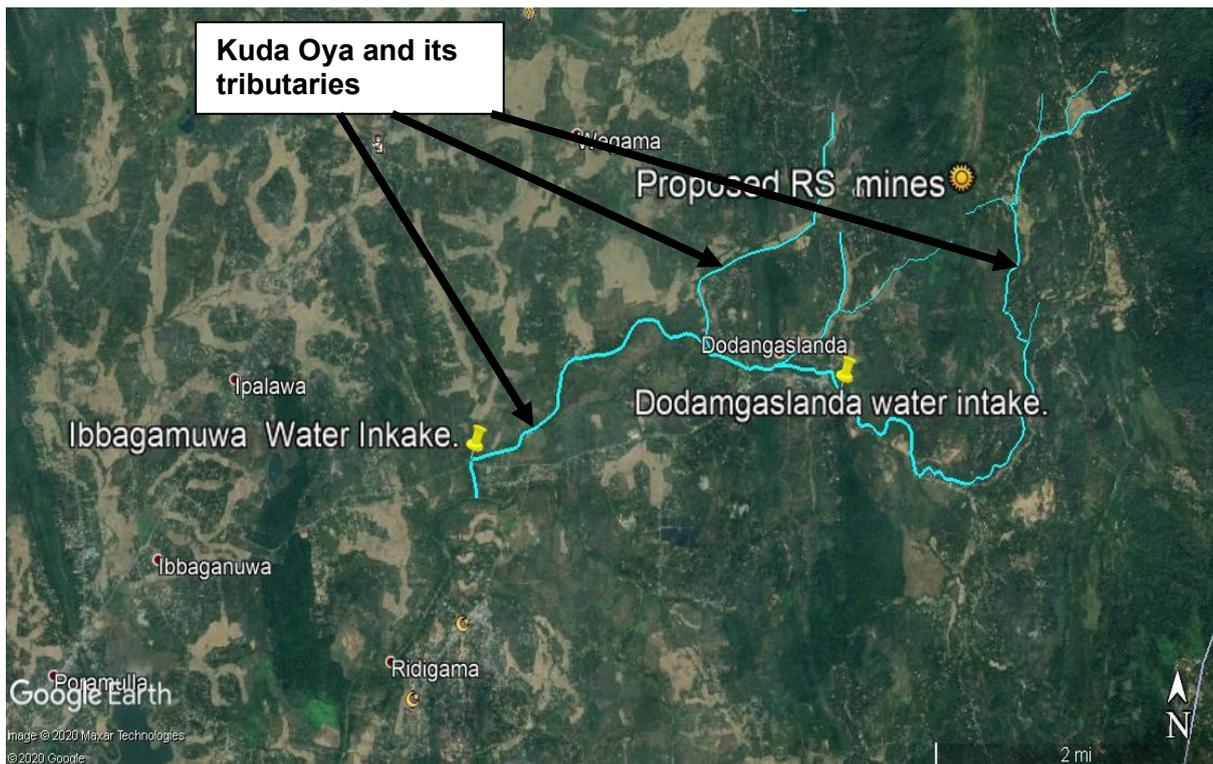
Parameter	SLS potable water guidelines (SLS 614,2013)	Kuda Oya
Colour	15 units	Less than 2.5
Turbidity in NTU	2 NTU	0.3
pH (lab)	7.0 to 8.5	6.4
Electrical conductivity in $\mu\text{s}/\text{cm}$ (lab)	750-3500	234
Total Hardness in mg/l (as $\text{CaCO}_3$ )	250	98
Total Alkalinity in mg/l (as $\text{CaCO}_3$ )	200	104
Total Dissolved solids in mg/L	500	156
Free Ammonia as $\text{NH}_3$	0.06	0.1
Total Iron in mg/l (as Fe)	0.3	0.02
Chloride in mg/l (as Cl)	250	14
Fluoride mg/l as F	1.0	0.47
Nitrate mg/l as $\text{NO}_3$	50	Less than 0.5
Nitride mg/l as $\text{NO}_2$	3	Less than 0.007
Sulphate in mg/l as $\text{SO}_4$	250	5
Phosphate in mg/l $\text{PO}_4$	2	Less than 0.06

The chemical analysis indicates that all studied parameters except free ammonia are as per the SLS drinking water guidelines.

### 3.1.1.3.4 Present Use of Surface Water and Groundwater

The groundwater of the area mainly uses for the drinking, bathing, and household purposes. However, some of wells go dry during the dry period and some wells are used by two/three families. In addition, large diameter dug well (DW 10) has been constructed to extract groundwater at the area closer to the paddy land to supply water to the village (80 families) for drinking purposes and construction of other structures of CBO based village water Supply Scheme (WSS) is in progressed.

The surface water in Kuda Oya is used for drinking, domestic, and paddy fields. All seasonal minor streams mainly used for the paddy field. It is noted that water in the Kuda Oya has been taped in two places to extract water for the Dodangaslanda and Ibbagamuwa WSSs. The distance from the proposed RS graphite mining site to Dodangaslanda and Ibbagamuwa water supply intakes are about 3 km and 6.5 km, respectively. The location map of the Dodangaslanda and Ibbagamuwa water supply intakes with proposed RS graphite mining site are given in Figure - 3.1.1.3.4.



**Figure - 3.1.1.3.4:** Kuda Oya and its tributaries with water supply intakes of Ibbagamuwa and Dodangaslanda

### **3.1.1.3.5. Drainage Pattern**

Ridge and valley are characteristic topographical feature in the study area. The total land area for proposed sand mining site is about 8 acres and its slope angle varies from 5% to 25%. The elevation of the study area varies from 160 m to 500 m mean sea level. The selected land for the graphite mining project shows sloping topography. It was noted that overland flow of the proposed mining land flows to the Kuda Oya through seasonal minor stream (A) and (B). More than 80% of overland flow of the proposed mining land flows to the seasonal minor stream (A).

It is noted that several valleys are developed at the study area mainly along two directions. Some of the valleys are developed along the direction parallel to the strike of the rock (N-S) and some valleys are developed along the NE-SW direction.

In the study area, Part of Kuda Oya and other seasonal minor streams (C, D, E) are flowing along the N-S oriented fractured zones. The seasonal streams (A and B) run along the NE-SW oriented fractured zones. The distribution of valleys and streams within study area (Kahatagaha Graphite mine and proposed RS graphite mine areas) are totally controlled by the structural geological set up of the area.

The existing Kahatagaha Graphite mine is located about 500 m away from the Kuda Oya towards the western side. According to the information received, present depth of the mine is more than 800 m below ground level and length of some crosscut is more than 300m. Still mining is in progressed under dry condition without any groundwater ingress to the mine. Also, any depletion of water level in dug wells or discharging quantity of the Kuda Oya has been not recorded so far. It revealed that there is not any hydraulic connection between Kahatagaha Graphite mine and Kuda Oya. The hydrological and hydrogeological conditions in proposed RS mines can be similar to Kahatagaha Graphite mine due to presence of similar structural geological set up. The chances of having hydraulic connection between proposed RS mine and Kuda Oya could be minimum level.

### **3.1.1.3.6. Overburden and Surface Stability**

Thickness of the overburden cover on the top of the project area varies from 0 – 5m and it comprises of orange, brown lateritic soil cover (Plate – 3.1.1.3.6) and residual soil cover & highly to completely weathered rock formation of garnetiferous quartzofeldspathic gneiss and charnockitic gneiss rocks. At places dumped rock boulders during previous graphite mining activities are also identified (Plate - 3.1.1.3.6a). At some places of the hill slope, unstable rock boulders exit. Hence, it is

highly recommended to remove such boulders, prior to commencement of the mine with the advice of an experienced landslide specialist.



**Plate – 3.1.1.3.6:** Orange brown lateritic overburden soil cover within the project area



**Plate – 3.1.1.3.6a:** Presence of dumped rock boulders during previous graphite mining activities at places on the top of the overburden cover

Only minor disturbances were made to the overburden cover during preparation of project related structures and stockpiling areas.

During the previous development of private access road, leading to the mine entrance, hill slope embankment had been disturbed up to 3m height. As a result, minor slope collapsing was occurred at the roadside slope embankment (Plate – 3.1.1.3.6b)



**Plate – 3.1.1.3.6b:** Minor collapsing of roadside slope embankment at place along the access road

Hence, it is highly recommended to shape the roadside slope embankments with more than 2m height in 1:4 ratio and allow to grow fast growing plants on the slope in order to control minor roadside slope collapsing.

In addition, during previous mining activities, overburden cover on the hill slope around the mine entrance had also been disturbed to some extent up to the bed rock level (Plate – 3.1.1.3.6c) in order to open up the mine entrance.

However, under this project, removal of overburden cover would not be required. Instead, adits / shafts structures of the abandoned mine were cleaned by removing the dumped and collapsed overburden materials, during the cleaning process of the mine.



**Plate – 3.1.1.3.6c:** Overburden cover on the hill slope around the mine entrance had been disturbed to some extent up to the bed rock level

During the recommencement of mining activities, abandoned underground adit and shaft structures will only have to be extended from the respective terminated depths. Hence, when recommencing mining activities, there is no requirement to disturb the overburden cover, as mining activities are to be conducted only in the underground, by extending abandoned adit and shaft structures by blasting the parent rock.

Since all the proposed mining activities are to be extended by developing adit and shaft structures from the already erected shaft structures, overburden cover in the rest of the project area would not be required to disturb.

Hence, surface stability related issues would not be expected due to the recommencement of underground mining activities.

However, it is highly recommended to follow the recommendations made by the NBRO (Annex – 2.4.8).

### **3.1.1.3.7. Meteorological Data (Rainfall, Temperature, Humidity, Wind Pattern, etc.)**

#### **Rainfall**

Available rainfall data around the project region were searched from the Department of Meteorology. It was revealed that the nearest rainfall station, where the relevant data is available, is at Dodangaslanda and is situated about 3km towards SSW direction from the project site. Rainfall data on monthly basis for the period of 2010 – 2020 was recorded and are displayed in Table – 3.1.1.3.7.

**Table 3.1.1.3.7: Rain Fall Data at Dodangaslanda Gauge Station for the Period of 2010 – 2020**

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2010	39.5	7.7	123.3	336.3	231.7	131.4	236.1	150.5	190.0	239.3	436.2	408.9
2011	292.6	NA	NA	305.7	70.8	43.2	15.9	25.1	68.7	237.0	147.2	84.9
2012	24.4	102.8	NA	231.6	1.2	123.0	50.9	81.3	19.9	439.6	405.3	596.9
2013	206.4	101.1	140.8	184.5	257.2	113.7	81.9	53.9	141.4	493.2	105.0	69.0
2014	94.3	NA	2.2	410.1	177.2	65.2	37.4	149.4	NA	494.5	298.1	696.3
2015	2.8	62.7	31.4	261.6	314.3	98.9	11.0	229.8	101.9	0.0	347.9	289.3
2016	6.1	13.0	NA	104.2	610.2	107.9	36.6	23.1	0.0	100.4	178.4	79.1
2017	128.0	132.8	285.1	NA	236.4	128.0	11.0	71.5	255.6	260.9	210.4	83.4
2018	13.9	7.0	104.5	107.0	349.3	108.4	29.5	113.0	344.0	492.4	305.1	145.7
2019	1.0	75.8	46.5	118.6	20.7	67.0	77.9	92.8	228.7	655.5	206.1	240.2
2020	71.2	5.0	20.7	185.9								

The above meteorological data indicate that the area experiences heavy rains from October to January when the north-east monsoon prevails. In the months of April and May, the area receives moderate rainfall. In comparison, amount of rainfall in rest of the months is very low.

### **Temperature**

Available Temperature data around the project region were searched from the Department of Meteorology. It was revealed that the nearest temperature measuring station, where the relevant data is available, is at Kurunegala and is situated about 20km towards SW direction from the project site. Temperature data on monthly basis for the period of 2010 – 2020 was recorded and are displayed in Table – 3.1.1.3.7a.

According to the above table, the highest average monthly temperature is recorded in the month of 2020 March (30.3°C) while the lowest average monthly temperature is encountered in the month of January 2010. (24.4°C).

**Table 3.1.1.3.7a: Temperature Data at Kurunegala Gauge Station for the Period of 2010 – 2020**

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2010	26.0	28.0	29.5	28.7	28.1	27.5	27.2	27.2	27.2	26.8	26.3	25.1
2011	24.4	25.8	27.7	27.4	27.9	27.6	27.7	27.5	27.2	27.6	26.3	25.6
2012	26.0	27.0	28.8	28.0	29.2	28.2	28.1	28.1	28.4	27.9	26.8	26.4
2013	25.5	27.2	28.7	29.3	28.5	27.1	27.5	28.1	27.1	27.6	27.3	26.0
2014	26.4	27.5	29.2	28.9	28.7	28.6	28.3	27.5	27.4	27.2	26.0	25.7
2015	26.6	27.1	28.5	28.3	28.7	28.4	28.8	28.8	28.1	27.6	27.2	26.9
2016	27.4	28.4	30.1	29.8	28.3	28.3	28.3	28.8	29.0	28.7	27.0	27.0
2017	26.1	26.9	28.2	29.7	29.1	28.4	28.9	28.6	27.8	27.7	27.1	26.7
2018	26.2	28.2	28.9	28.9	27.9	28.0	28.1	27.8	28.8	27.4	27.0	26.4
2019	26.8	28.3	29.5	29.8	30.0	28.9	28.5	27.7	27.7	26.9	27.7	26.6
2020	27.7	28.6	30.3									

### **Wind Pattern**

When wind speed is considered, it is somewhat higher during the months of June to September while in rest of the months, wind speed is comparatively low (Table – 3.1.1.3.7b).

**Table – 3.1.1.3.7b: Resultant Wind Data at Kurunegala Gauge Station for the Period of 2010 – 2020**

Year	January		February		March		April		May		June	
	Dir.	Spe.	Dir.	Spe.	Dir.	Spe.	Dir.	Spe.	Dir.	Spe.	Dir.	Spe.
2010	039	2.5	036	2.7	286	2.0	221	1.3	218	2.8	218	3.3
2011	043	1.3	023	1.5	027	1.9	220	1.1	224	2.5	219	3.1
2012	019	**	029	**	242	**	217	**	221	**	213	**
2013	024	**	027	**	191	**	225	**	207	**	211	**
2014	056	3.9	051	4.1	064	4.2	221	2.7	219	3.8	226	6.0
2015	050	3.5	064	4.1	081	3.1	173	2.5	206	4.1	213	5.1
2016	052	3.7	064	3.3	005	3.1	219	1.7	218	3.3	229	4.3
2017	055	2.0	052	2.5	245	1.3	225	2.2	219	3.0	220	3.4
2018	040	2.7	047	3.9	055	2.5	245	1.7	222	2.7	222	4.1
2019	048	3.1	049	3.1	060	2.5	239	1.2	224	4.5	219	4.7
2020	048	2.1	048	4.0	031	1.9	210	2.1	220	2.9	222	4.1

Year	July		August		September		October		November		December	
	Dir.	Spe.	Dir.	Spe.	Dir.	Spe.	Dir.	Spe.	Dir.	Spe.	Dir.	Spe.
2010	219	2.9	218	3.3	216	2.4	223	2.3	218	1.0	027	2.3
2011	222	3.4	215	**	207	**	210	**	354	**	027	**
2012	211	**	210	**	207	**	211	**	259	**	036	**
2013	213	6.4	211	6.7	212	5.9	215	4.9	037	1.7	047	3.2
2014	219	5.6	215	4.6	218	5.6	207	2.1	070	1.4	052	1.8
2015	219	6.3	217	5.5	211	4.6	197	2.1	114	1.7	066	1.8
2016	224	4.6	228	5.7	229	6.1	230	3.9	052	1.5	048	2.3
2017	216	4.1	223	4.1	249	3.3	214	2.4	071	1.2	052	2.3
2018	222	6.3	222	5.6	227	3.9	239	1.3	014	1.3	041	1.7
2019	224	4.8	225	4.5	2217	3.0	226	1.1	124	1.5	061	1.5
2020												

- \*\* - Data Not Available  
Dir. - Direction from North  
Spe. - Speed in km/h

### **3.1.1.3.8. Natural Disasters in the Project Area (Landslides, Earthslips, Floods)**

Landslides or earth slips have not been reported previously covering the hill slopes in and area around proposed graphite mining site at Kotuhena, except for very minor roadside slope collapsing.

According to the Landslide Hazard Zonation Map prepared by the NBRO, the proposed mining area belongs to Modest Level of Landslides Hazards Exist” zone (Annex – 2.4.8).

NBRO report further stated that the project can be accepted from the landslide hazard risk.

NBRO further stated that following recommendations should be adhered during the implementation of the project.

- Due to disturbing the morphology, some slope instabilities may arise. Hence, a further technical report should be obtained from the NBRO after 1 year period.
- Loose and unstable rock blocks / boulders, located on the top of the mine slope, should be removed prior to implementing the project.
- Weak sections of the walls of the adits / shaft structures should be concreted.
- Natural storm water paths, covering the hill slopes of the project area should not be blocked.
- Rubble masonry cutoff drains (0.6m x 0.6m) should be erected, covering the upper hill slope of the mine structure, as shown in the NBRO report.

All the disturbed land areas covering the hills slope of the mine area should be maintained in 1: 4 ratio and either grass turfed, rock paved or concreted in order to control soil erosion and slope collapsing.

In addition, it is highly recommended to implement the proposed drainage management plan by erecting rubble masonry, earth and contour drainage paths with silt traps.

Proposed Drainage Management Plan is shown in Fig. 3.1.1.3.8.

Landslide Hazard Investigation Report prepared by the NBRO is given in Annex – .8.

### **3.1.2. Possible Contamination / Disturbances to the Existing Drainage Path**

The site preparation, stockpiling, mining, pumping, and discharging of seep water, and transport are the main activities of the proposed graphite mining project. The planned mining depth of the proposed project is 180 m below the general ground level.

Due to project activities, less number of fine materials including rock fragments will be added to environment. Part of finer materials (clay, rock dust, and graphite particles) may flow to the Seasonal Minor streams(A) and (B) through drainage paths during the rainy period. These materials could be deposited on the drainage paths and seasonal

minor streams. The expected number of materials to be added to drainage paths and Kuda Oya could be low due to presence of grass/bush types vegetation on the ground surface. Therefore, any significant disturbance to seasonal minor streams due to proposed graphite mining project could not be expected.

In addition, aluminum nitrate fuel mixture, or/and dynamite sticks, or/and blasting powder are used as the blasting agent. Drilling and blasting techniques will be used for mining. During the blasting, a fraction of explosives could be left out as residue in the form of unexploded materials. Part of these explosive residues could be mixed and diluted with the seep water in the mine. The expected seep water quantity could be very less (few cubic meters of water) or dry conditions in the mine could be expected with the increasing of mining depth. The expected impact from the contaminated seep water could be low or negligible.

Since many workers are employed in the activities in the mine, solid and biodegradable waste will be generated. These wastes could be added to the surface water and ground water as a result of improper management. Therefore, these wastes could be managed properly in order to control the expected impacts.

In addition, different types of machines will be involved in mining and transportation activities. Different types of petroleum products such as petrol, diesel, Oil, and lubricant will be used regularly to run all machines and periodic maintenances. The petroleum products could be leaked to the ground surface during servicing or due to unexpected leakage. These petroleum products could be infiltrated into the ground or move with overland flow during the rainy period. Therefore, periodic vehicle services should be done at service station and any waste oil should not be discharged to the environment.

### **3.1.3. General Position of the Proposed Mining Site with Respect to the Groundwater Table**

The elevation of the top and bottom of the proposed RS graphite mining site is 400 m mean sea level and 220 m mean sea level, respectively.

The groundwater mainly occurs in three geological formations such as alluvial deposit, lower part of the overburden, and fractured formation. The alluvial formation of the area is associated with Kuda Oya in riverbanks and old river paths. The occurrence of groundwater in the overburden is confined to the area close to the valleys, depressions on the slope, breaking slopes, and flat area close to Kuda Oya and paddy land based on hydrogeological conditions of the sites. The overburden aquifer acts as unconfined aquifer in seasonal and perennial nature. The availability of groundwater in the hilly area are limited to the stream areas and localized groundwater table has developed in several places in between 200 m- 300 m mean sea level along the paths of stream(A)

and (B). The lower part of the overburden at the area closer to paddy land and Kuda Oya is water bearing and general water table of the area is 185-190 m mean sea level.

Hydrogeologically, water bearing fractured formation of the study area act as semi-confined aquifer and its groundwater level is similar to the general water table of the overburden at the area closer to paddy land and Kuda Oya. According to the proposed mining depth, proposed mining depth is above the general groundwater level of the investigated area.

### **3.1.4. Structure and Lithology**

Ninety percent of the island of Sri Lanka is underlain by Proterozoic high grade metamorphic rocks with Miocene sediments (limestone) being restricted to the NW, N and NE coastal regions as a narrow strip. Geologically Precambrian metamorphic crust of Sri Lanka can be sub divided into three major lithotectonic units, namely Highland Complex (HC), Vijayan Complex (VC) and Wannai Complex (WC). Simplified lithotectonic map of Sri Lanka is shown in Figure – 3.1.4

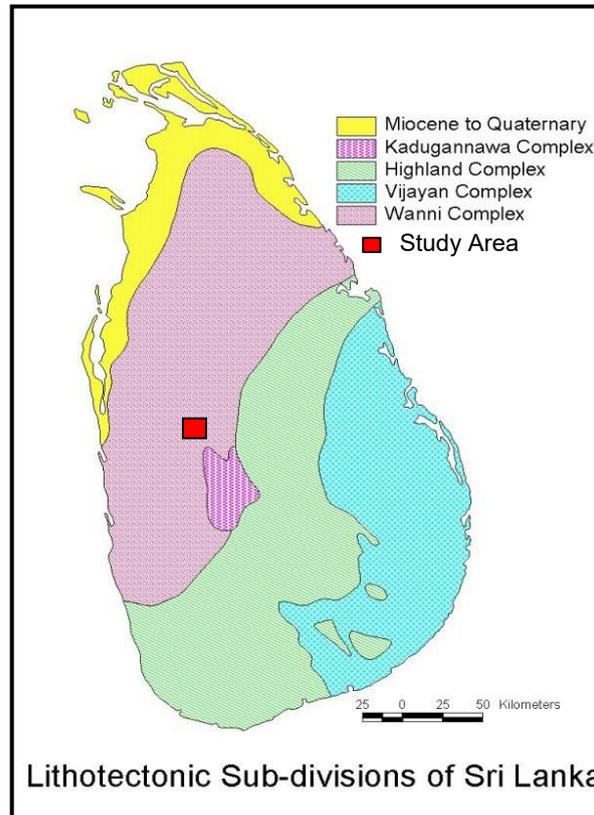
According to the above nomenclature, the entire study area is located within the Wannai Complex (Fig. – 3.1.4).

A substantial part of the Wannai Complex is made up of amphibolite facies rocks but the areas adjacent to the Highland Complex are of granulite grade which includes both charnockite and meta pelites. There is no clear structural break between rocks of the Highland and Wannai Complexes. Therefore, precisely defining the boundary between Highland and Wannai Complexes is not possible at the present moment. However, isotopic data of these two Complexes are different. The WC is considerably younger than rocks of the HC and also records lower metamorphic pressure. Zircon ages for foliated Wannai granitoids are between 1000 – 1100 Ma with metamorphic overprint at 560 Ma (Kroner et. al. 1991) and depositional age HC rocks is 2000 Ma. The Wannai Complex characterized by thick sequences of ortho gneisses comprises of migmatitic, granitic and granodioritic gneisses. In the northeast section of the Wannai Complex, granulite grade variants such as charnockitic rocks and minor granulite grade metasediments are common. These rocks being introduced by K-feldspar rich melt in late stage. Calc gneiss bands are identified but untraceable very far.

The metamorphic grade of the Wannai Complex is distinctly lower than that of the Highland Complex with a distinct gradient into the latter, although portions of the complex exhibit structurally controlled granulite-amphibolite retrograde transitions and in-situ charnockites.

The area examined falls within the 1: 100,000 scale geological sheet no.11 (Dambulla – Pallegama) published by Geological Survey and Mines Bureau in the year 1996.

The dominant rocks in the area are garnetiferous quartzofeldspathic gneiss, charnockitic gneiss, charnockitic biotite gneiss, quartzite, and hornblende biotite gneiss (Fig. - 3.1.4A). Present study of the graphite mineralization at RS Mine revealed that the veins are found in garnetiferous quartzofeldspathic gneiss and charnockitic gneiss rock formations (Fig. – 3.1.4B).



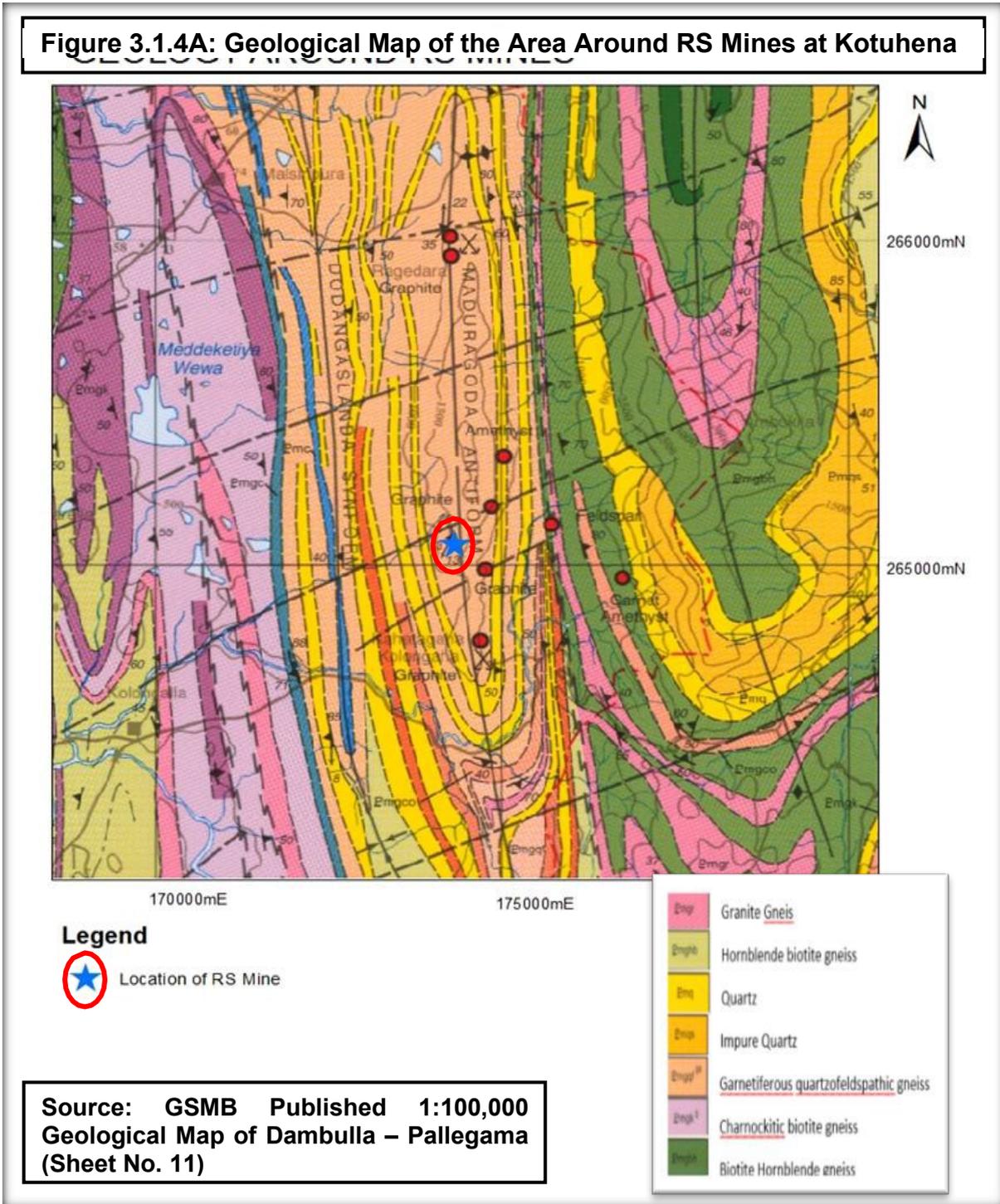
**Figure – 3.1.4:** Simplified Geological Map of Sri Lanka,  
note: Study area is highlighted in red colour box

The general rock structure in the basement rock is indicated by a penetrative foliation, averaging N10<sup>0</sup>W. Regionally, several episodes of intense deformation have resulted in complex fold pattern in the area. The supracrustal rocks of the region have been faulted or sheared during the deformation episodes. The fracture systems in the area indicates north-west and south-east with steep dips. These are well exposed in the abandoned pits.

The RS Mines area is located closer to the fold axis of the “Maduragoda antiform” indicating higher possibility for the occurrences of thick graphite veins. The association of the deposits with high grade metamorphic rocks, their wide lateral extent and the grade and flake size of the graphite, suggests that they are ,most probably ,of hydrothermal origin (Katz 1987).

Presence of thick bands in the deeper parts of the presently active mines (Kahatagaha-Kolongaha mines) located to the south of the area, indicates the possibility of thick veins of graphite occurrences in the target area too.

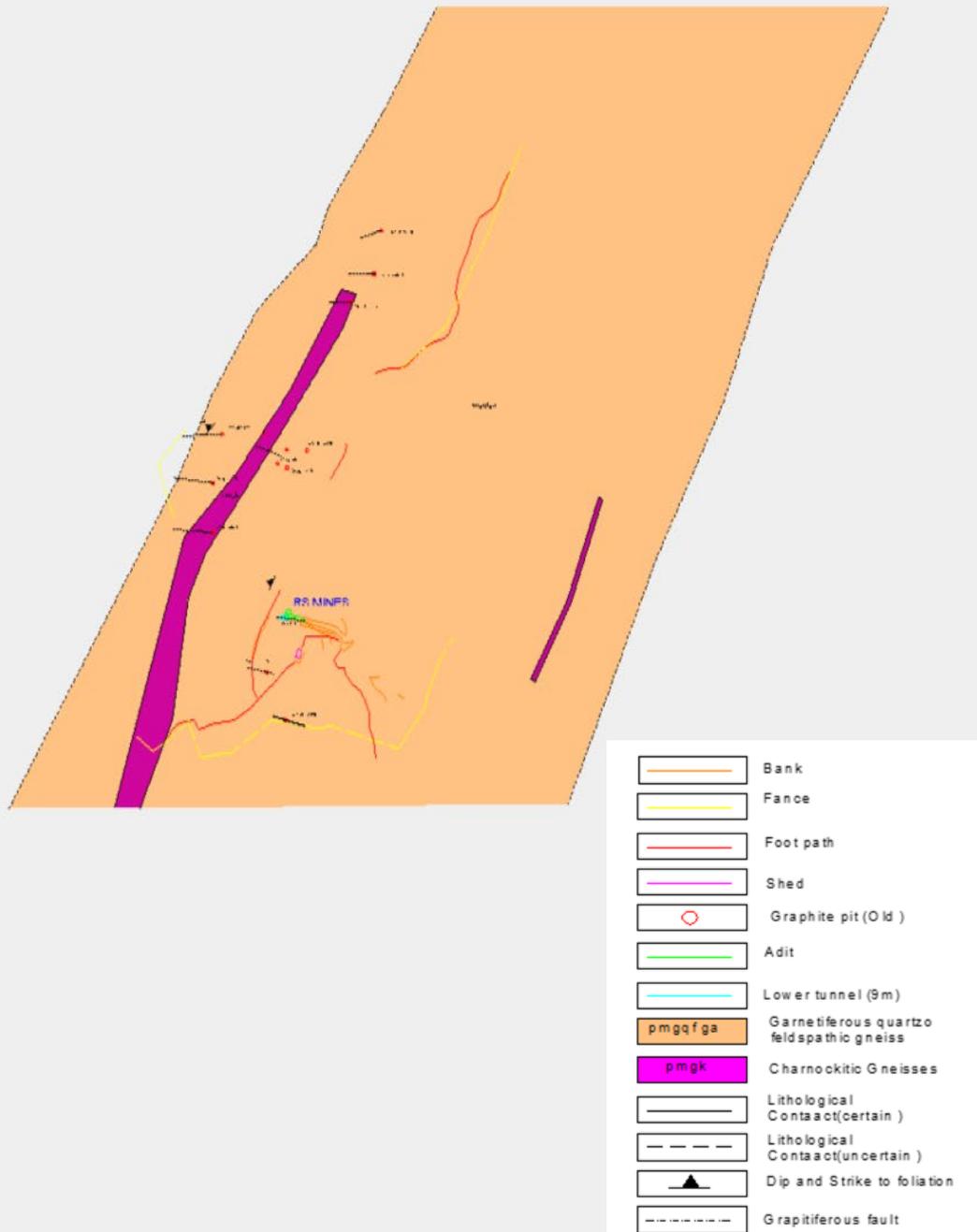
**Figure 3.1.4A: Geological Map of the Area Around RS Mines at Kotuhena**



**Source: GSMB Published 1:100,000 Geological Map of Dambulla – Pallegama (Sheet No. 11)**

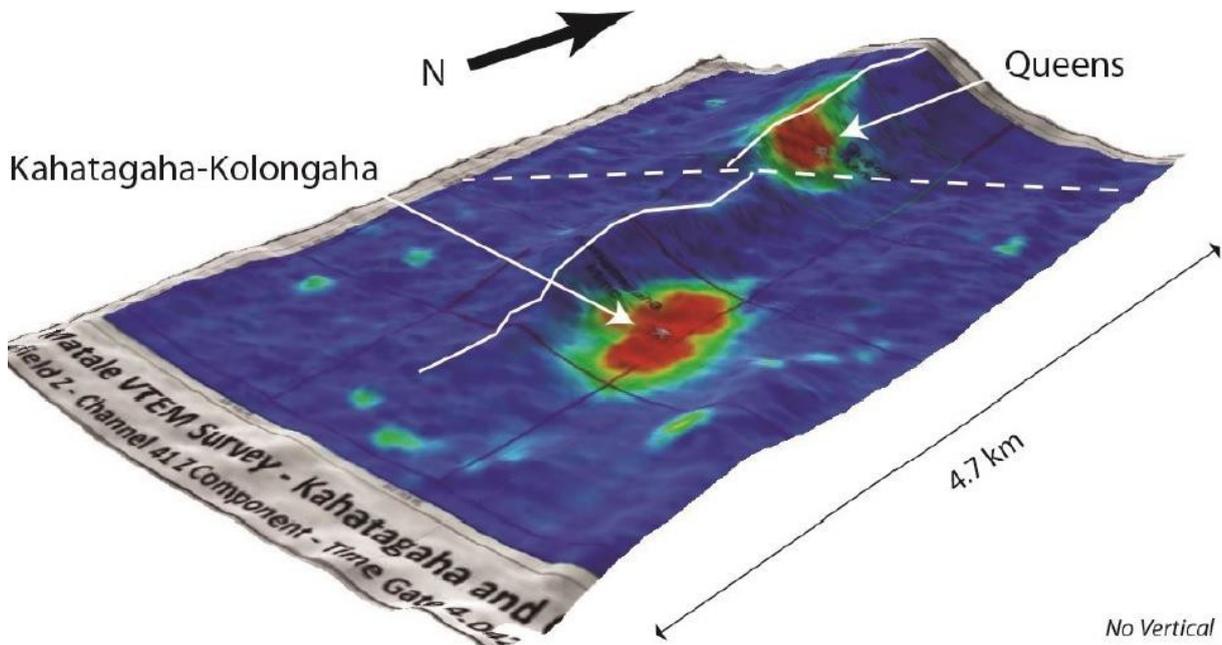
**Fig. 3.1.4B**

**Detailed Geological map of the Area Covering RS Mine at Kotuhena in Maduragoda near Dodangaslanda**

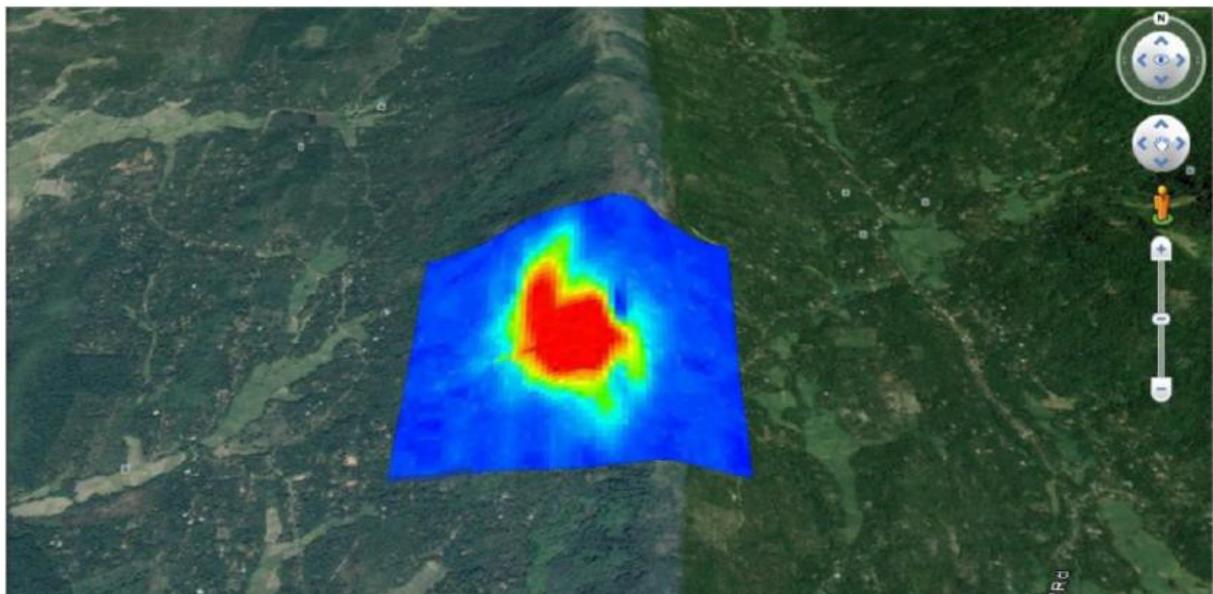


### **Air Borne Geophysical Survey Results**

The RS mine situates in high potential graphite mineralization zone in Sri Lanka. According to the result of the airborne survey done by Bora bora company in year 2014, the positive anomalies were identified at mine land and its covering exploration areas (Figures - 3.1.4C & 3.1.4D).



**Figure – 3.1.4C:** Positive anomaly show in terrain (red color) around Kahatagaha – Kolongaha and RS Mine premises area (Queens’s pit)



**Figure – 3.1.4D:** The blue square (1km) owned by RS mine within positive anomaly

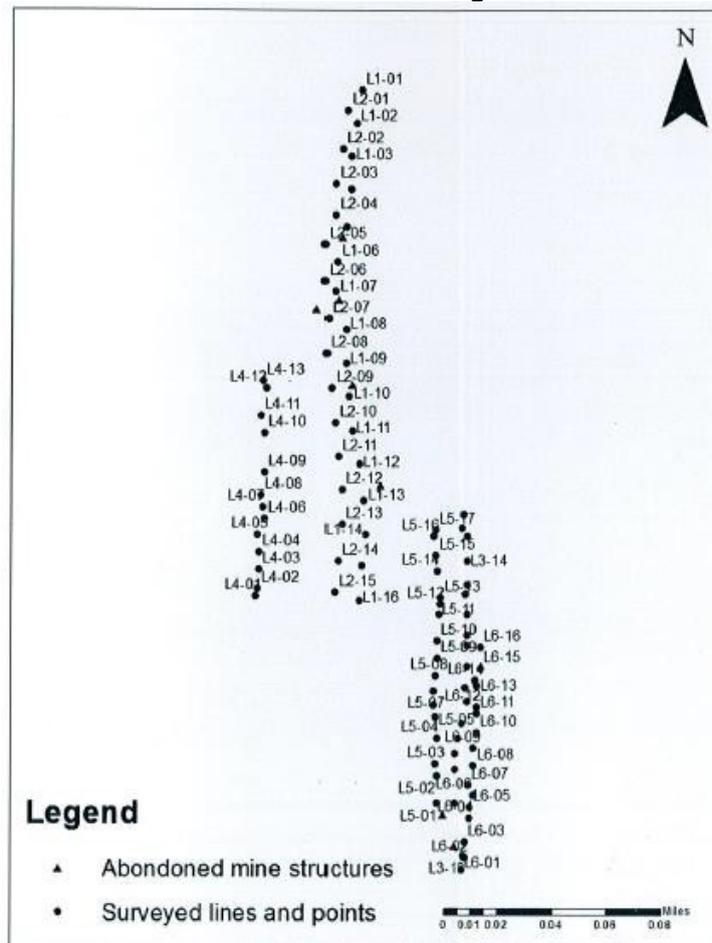
### Geophysical Study

VLF instrument was used to carry out the ground geophysical survey (Plate – 3.1.4).

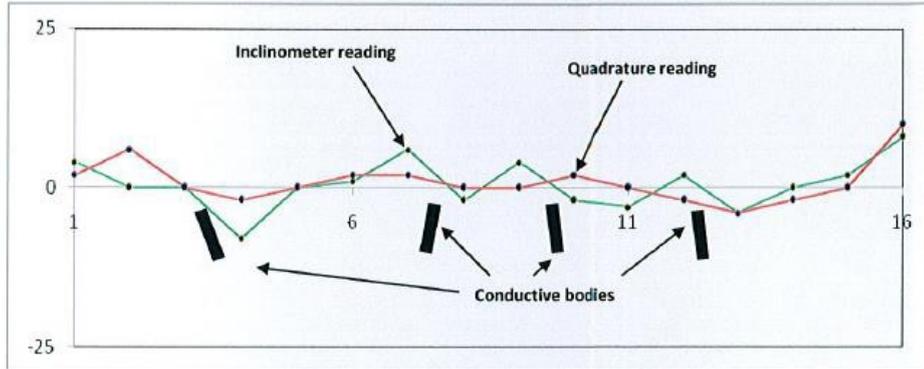


**Plate – 3.1.4:** Getting Field Measurements using EM-16 (VLF) Instrument

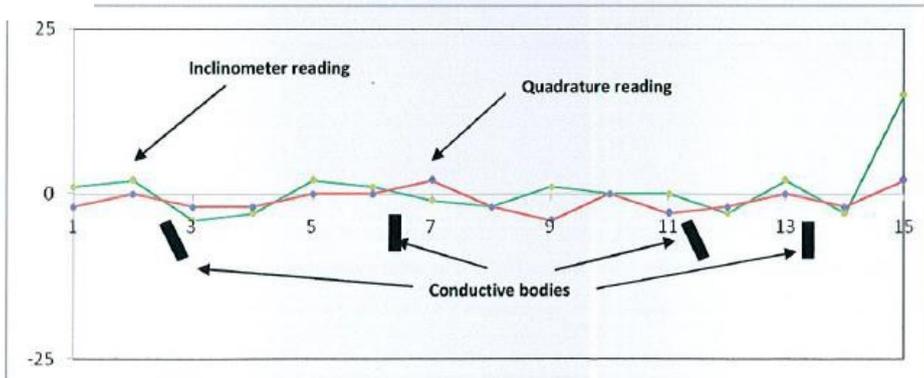
**Figure 3.1.4E** The Line and Points Arrangement of the Survey Area



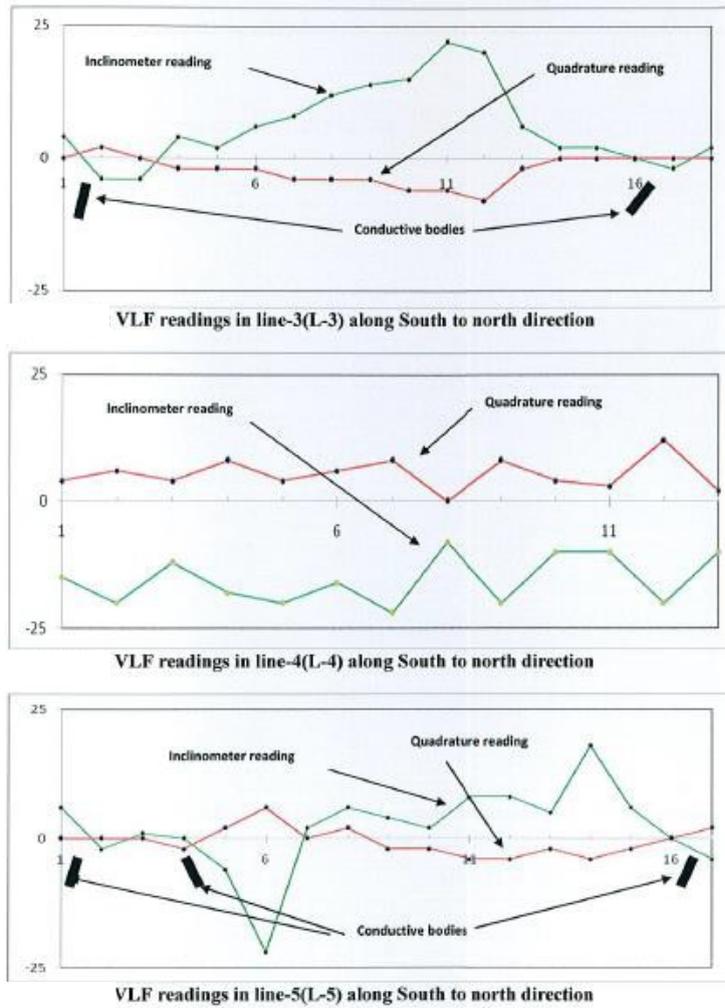
**Figure – 3.1.4F: Anomaly Details**



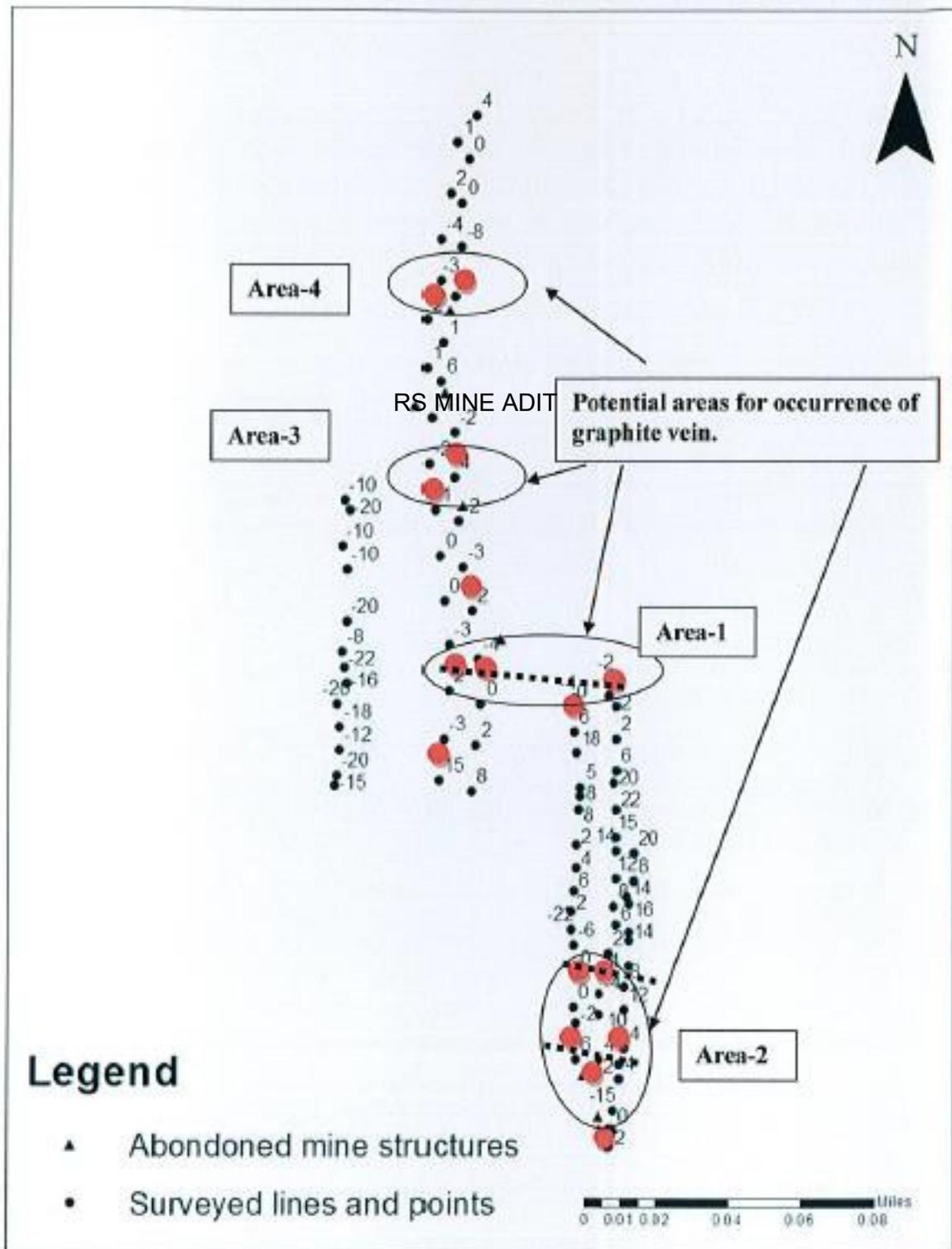
**VLF readings in line-1(L-1) along South to north direction**



**VLF readings in line-2(L-2) along South to north direction.**



**Figure 3.1.4G: Potential Conductive Bodies**



### Core Drilling Program

Drilling activities of the exploration program were conducted by Geological Survey and Mines Bureau. Seven drill holes were completed under the drilling program. The summary of drill holes is shown in Table - 3.1.4.



## DRILL HOLE COLLAR SUMMARY

Apr 07, 2018

Hole Id	Northing	Easting	Elevation	Depth	Dip	Azimuth
DH001	265218.00	174501.00	387.81	67.90	-60.00	330.00
DH002	265224.00	174500.00	387.85	150.20	-60.00	280.00
DH003	265109.00	174535.00	352.80	200.30	-60.00	317.00
DH004	265259.62	174403.52	425.71	111.70	-60.00	330.00
DH005	265318.18	174492.92	432.56	71.30	-60.00	330.00
DH006	265344.19	174429.98	443.57	81.30	-60.00	330.00
DH007	265147.25	174436.49	409.55	265.60	-60.00	317.00

**Table 3.1.4:** All coordinates and depths are shown in meters and dip and azimuth are shown in degrees

### Details of Completed drill holes

Seven drill holes were completed (out of eight drill holes planned) at the selected locations, covering the 3.5055 ha land owned by the project proponent. The azimuth of drill hole number two is not intersected the veins. The six numbers of drill holes intersected veins for considerable thickness as shown in following tables.



## DRILL HOLE LOG

Apr 07, 2018

HOLE ID : DH001

NORTHING : 265218      EASTING : 174501      ELEVATION: 387.807

MAXDEPTH: 67.9      AZIMUTH: 330      DIP : -60

From	To	Vein	Fracture
29.10	30.00	GBR	
45.90	46.00	10cm	
48.54	48.84	30cm	
51.33	51.43	10cm	
61.60	61.80	QzBGr	
62.30	62.35		GF



## DRILL HOLE LOG

Apr 07, 2018

HOLE ID : DH003

NORTHING : 265109      EASTING : 174535      ELEVATION: 352.8

MAXDEPTH: 200.3      AZIMUTH: 317      DIP : -60

From	To	Vein	Fracture
48.73	48.88	15cm	
86.70	86.73	3cm	
106.65	107.15	50cm	
109.65	109.68	3cm	
110.00	110.60	60cm	
111.00	111.02	2cm	
112.10	112.15		GF
150.30	150.35		GF
160.35	160.40		GF



## DRILL HOLE LOG

18

## DRILL HOLE LOG

Apr 07, 2018

HOLE ID : DH005

NORTHING : 265318.176      EASTING : 174492.921      ELEVATION: 432.562

MAXDEPTH: 71.3      AZIMUTH: 330      DIP : -60

From	To	Vein	Fracture
48.80	48.85		GF
62.30	62.65	35cm	

ure  
 \_\_\_\_\_  
 \_\_\_\_\_



## DRILL HOLE LOG

Apr 07, 2018

HOLE ID : DH006

NORTHING : 265344.192 EASTING : 174429.977 ELEVATION: 443.573

MAXDEPTH: 81.3 AZIMUTH: 330 DIP : -60

From	To	Vein	Fracture
67.90	68.10	20cm	
68.40	68.60	20cm	



## DRILL HOLE LOG

Apr 07, 2018

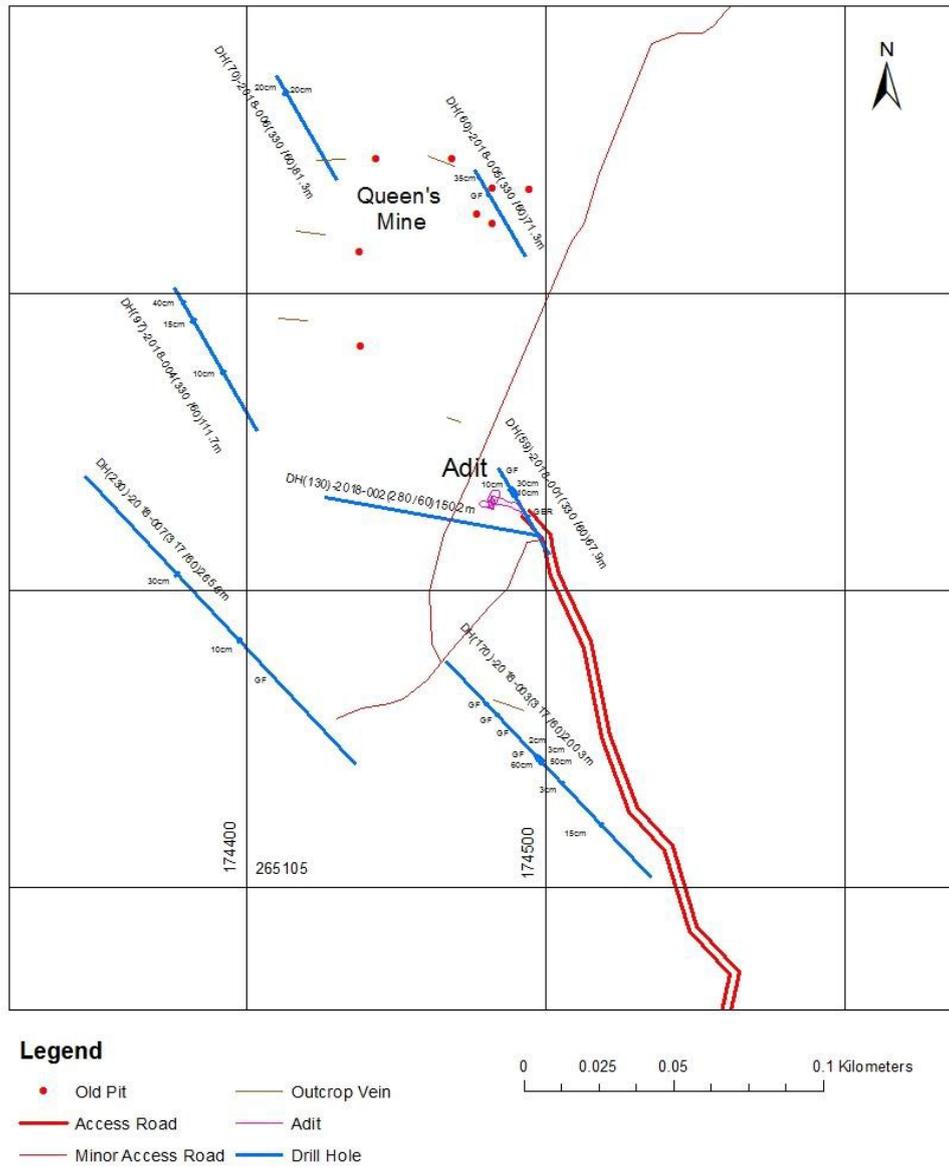
HOLE ID : DH007

NORTHING : 265147.245 EASTING : 174436.486 ELEVATION: 409.549

MAXDEPTH: 265.6 AZIMUTH: 317 DIP : -60

From	To	Vein	Fracture
86.70	86.75		GF
114.50	114.60	10cm	
175.30	175.90	30cm	

**Figure 3.1.4H: Details of completed drill holes at RS Mine Complex at Kotuhena**

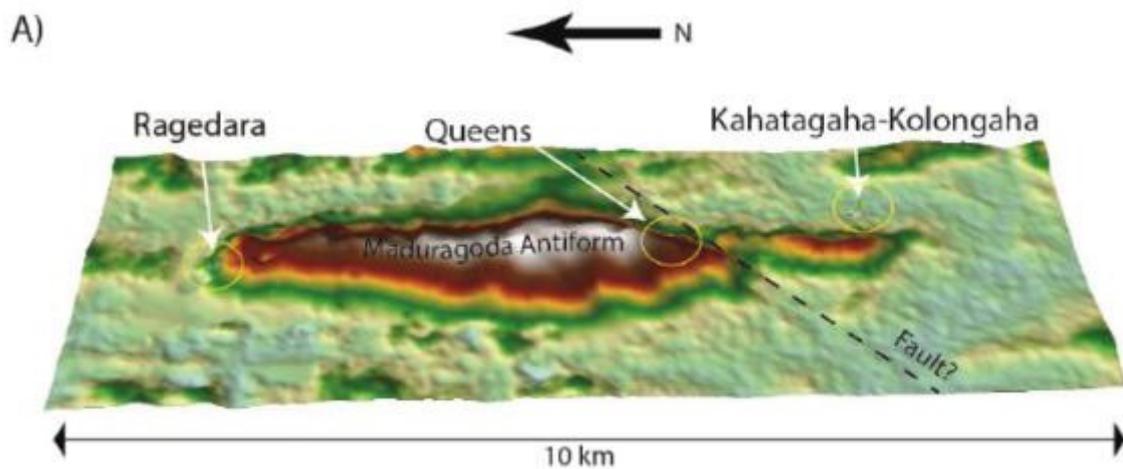


### 3.1.5. Mining of Soil, Clay or Sediments

This project is a graphite mining project. Hence, mining of soil, clay or sediments will not be involved in this project.

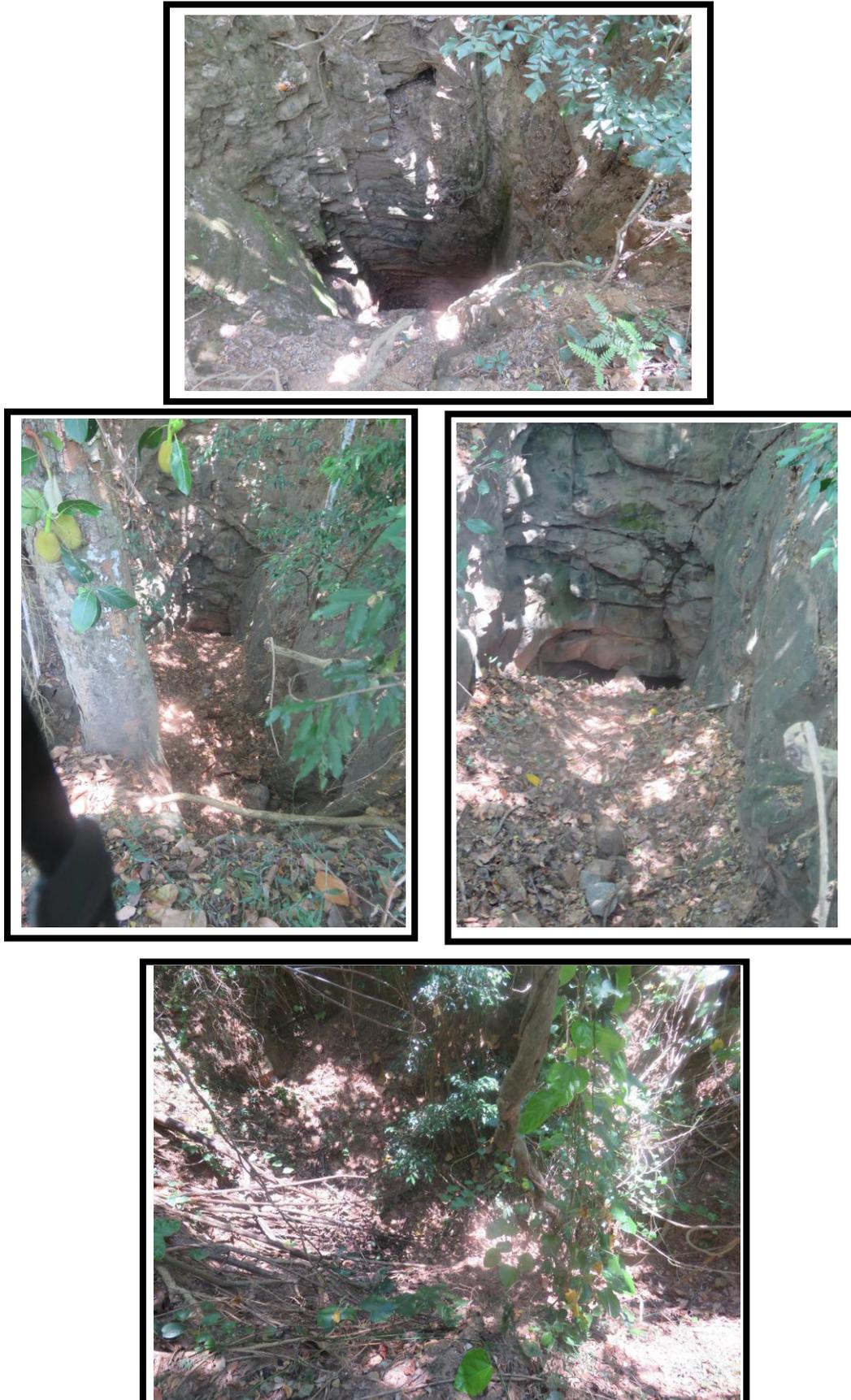
### 3.1.6. Abandoned Mining Locations & Mining History of the Area

The RS Mine at Kotuhena, which is situated in the Kurunegala District (2km from Kahatagaha graphite mine) (Fig. 3.1.6), is an area where open pit shallow graphite mining had been carried out at thirteen locations in early 20<sup>th</sup> century (Fig. 3.1.6A and Plate – 3.1.6). One of the pits is called Ragina pit (English meaning is Queens's mine) and it appears that the operation has been in considerable extent. Mining operations has been abandoned after some time back due to decrease in demands and lack of technology to conduct deep mining activities.



**Figure – 3.1.6:** Illustrates RS mine owned area between Ragedara mine and Kahatagaha - Kolongaha mine

**Fig. 3.1.6A:** Map Showing Abandoned Graphite Mining Localities around proposed R S Mine site at Kotuhena



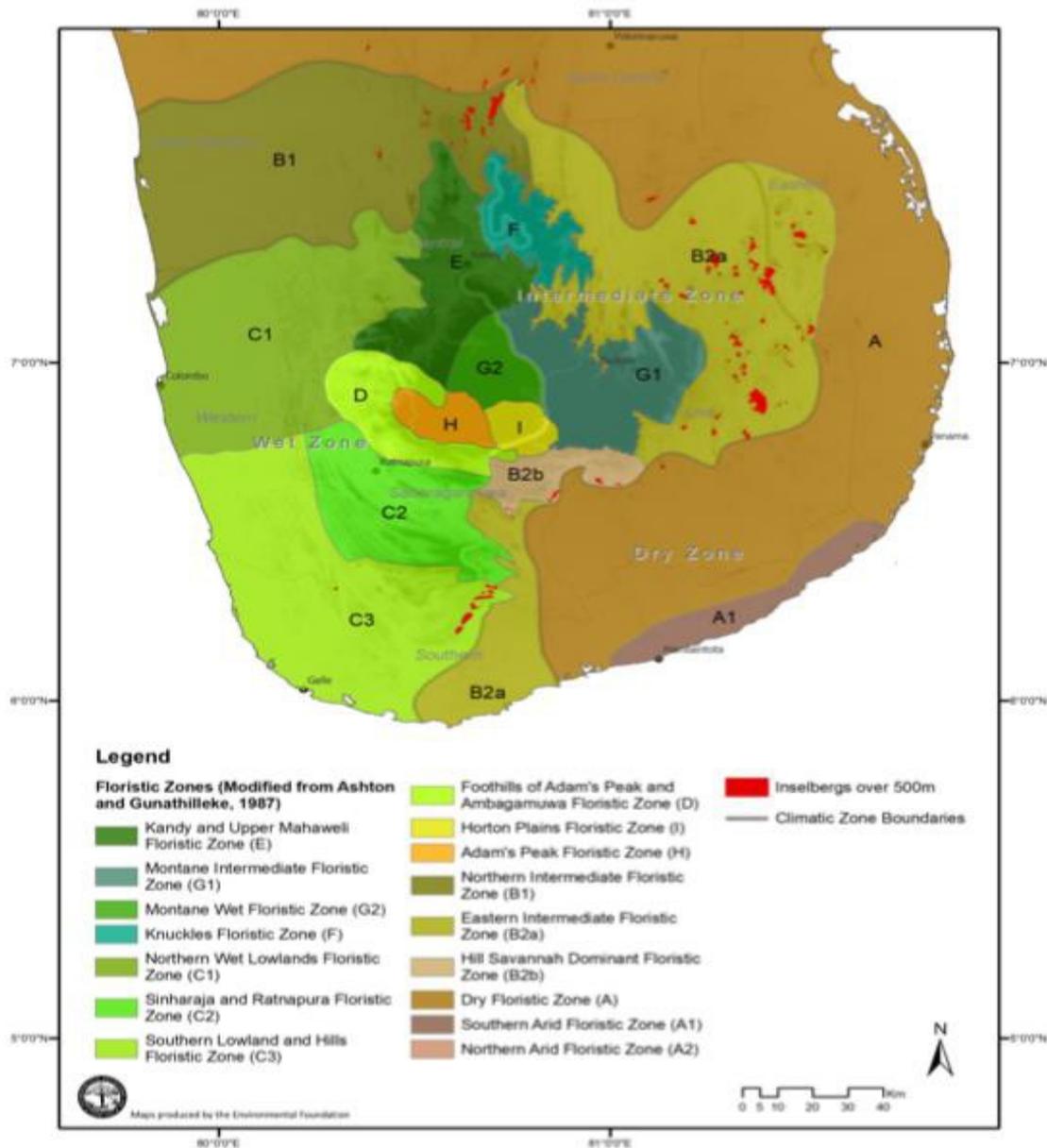
**Plate - 3.1.6:** Some of the Shallow Abandoned Graphite Mines Operated in Close Surrounding to the Proposed RS Mine

**3.1.7. Ambient Air Quality and Noise Levels in the Study Area and 25m on either Side of Material Transportation Routes, Which Come Under Local Authority or the Provincial Council**

### **3.2. Ecological Resources**

The proposed graphite mining site is situated in Welanruppa village, Kotuhena GND and Ridigama DSD, in Kurunegala district in the North-Western Province. The project area is found in the wet zone mid-country and close to the boundary of the intermediate mid-country having the elevation of about 403 m above sea level. Floristically it belongs to the Northern Intermediate Floristic Zone (B1) of the country (Fig 3.1, MoMD&E 2019 Biodiversity Profile - Sri Lanka). This region includes mid- elevational areas in the northern part of the intermediate climatic zone. This B1 region covers Daduru Oya, Karambala Oya and Ratmal Oya basins and is wetter than the other two regions in the intermediate climatic zone. The natural vegetation expected to see in this zone is tropical moist semi-evergreen forest with the *Filicium- Dimocarpus - Artocarpus- Myristica* series. The forest community in the B1 region is distinct from the eastern intermediate lowland and hill savannah dominant zone of the intermediate zone. Savannah vegetation cannot be found in this region.

Agro -ecologically the area belongs to the Wet zone mid-country (WM3b), with hilly, rolling, undulating and steep terrain, Reddish Brown Latosol (RBL), Immature Brown Loam (IBL), and Low Humic Gley (LHG) soils as the predominant soil types. The existing project area receives 1500-2000 mm annual rainfall. The mean annual temperature is >27.5°C and the average altitude of the project area is about 400 m above mean sea level (coordinates: 07.59063 80.54260; Fig. 3.2-3.3, Plates 1-10).



**Fig 3.2:** Floristic region of Sri Lanka, based on the distribution of principal vegetation types and dominant plant communities. The zones are modified from Ashton & Gunathilleke (1987)

### 3.2.1 Ecological Features (Distribution and Density) of Terrestrial and Aquatic Flora, Fauna

The natural vegetation formation of the project area expected to exist is moist-semi evergreen forest. However, this natural forest type is decimated a long ago due to the introduction of plantation crops and home gardens. At present the dominant man-made habitats in the surrounding area of the project site are coconut plantations, home gardens, paddy fields, agricultural fields and open areas having grasses, herbaceous and scrub vegetation. There are no forest reserves managed by the Forest Department or protected areas managed by the Department of Wildlife Conservation nearby the project site. The project site will not intersect or blocks any

wildlife corridors. Aquatic ecosystems such as natural swamps, marshes, and reservoirs, are not found in the project area. No archeological remains were identified within the site.

### **Methodology**

A reconnaissance survey was carried out to identify major habitats/vegetation in and around the project area. A rapid survey was conducted during the daytime in order to prepare a species inventory, to identify possible ecological impacts and to identify existing environmental problems/issues within and outside the project area. This survey included field assessment using line-transect method going through identified habitats/vegetation and literature review of recent related published materials. All groups of vertebrates such as Birds, Reptiles and Mammals and one invertebrate group (Butterflies) were the main groups of fauna focused on this survey. A floristic survey of the higher plants and lower plants were also carried out.

### **Flora Sampling**

A general survey was carried out in order to document the flora in the area. Direct recording methodology was used to determine the diversity of flora. Lists of plants were prepared with reference to different habitats / vegetation of the study area. In addition, threats and human disturbances associated with the habitat / vegetation types were also noted.

### **Fauna Sampling**

Sampling of fauna was done in parallel to the floral transects. Visual Encounter Survey (VES) method was used to record faunal species. Both direct and indirect observations (calls, foot marks, pellets, tracks) were made.

Secondary information on biodiversity and environmental issues were collected by personal communication with villagers and relevant officers. This was also done by reviewing published documents and unpublished data. In addition, photographic records were made of the visual aspects of habitats of proposed area.

The observed faunal and floral species were identified by using published descriptions and taxonomic keys provided by D'Abrera (1998), Das, I. and De Silva, A. (2005), Harrison (1999), Phillips (1935), Kotagama (2005), Manamendra-Arachchi and Pethiyagoda (2006), Das and De Silva (2005), De Silva (2006), Goonatilake (2007), Somaveera (2007), Dassanayake and Fosberg (1980 - 1991); Dassanayake, Fosberg and Clayton (1994 - 1995); Dassanayake and Clayton (1996 - 2000); Dassanayake, Clayton and Shaffer-Fehre (2006). The conservation status of the species was recorded according to the 2012 Red List of Threatened Fauna and Flora of Sri Lanka (IUCN SL and the ME&NR, 2012). Nomenclature of flowering plant is based on Senaratne (2001).

### Presence of natural habitats

Undisturbed natural habitats are not found in the project site. The major habitats found in the project area are coconut plantations, home gardens and secondary degraded vegetation, in the surroundings and paddy fields in the valleys. The vegetation found in the proposed mine area is secondary due to the degradation of natural vegetation. Plant species such as *Trema orientalis* (Gedumba), *Macaranga peltata* (Kenda), *Caryota urens* (Kitul) and *Alstonia macrophylla* (Hawari Nuga), are found in the area.

### 3.2.2. Identification of Rare, Threatened and Endemic Species

#### Flora of the Project Area

A total of 49 plant species and 36 indigenous species were recorded during the field survey within the study area (Table 3.2.2). Twelve plant species recorded at the study area are exotic and naturalized species which indicates that the area is disturbed due to human influence. All recorded flora species are not unique or restricted to the project area. Annex – 3.2.2 list all the plant species recorded in the project area during the study.

**Table 3.2.2:** Summary of the plant species recorded during the study

No of Species	Endemic Species	Nationally Threatened	Exotic Species
49	0	01	12

#### Fauna of the Project Area

The fauna comprises mainly of common species that are found associated with man modified habitat. A total number of 49 faunal species (18 Birds, 20 Butterflies, 6 Reptiles, 5 Mammals) were recorded from the proposed project area (Table - 3.2.2A). All recorded fauna species are not unique or restricted to the project area. Animal species recorded during the field study are listed in Annex 3.2.2A.

**Table 3.2.2A:** Summary of the faunal species recorded from the project area.

Taxonomic Group	Total Number	Endemic Species	Nationally Threatened	Exotic Species
Birds	18	0	0	0
Butterflies	20	0	0	0
Reptiles	06	0	0	0
Mammals	05	1	0	0
<b>Total</b>	<b>49</b>	<b>1</b>	<b>0</b>	<b>0</b>

### **Threatened and Endemic Flora and fauna**

A trees species recorded at the project site considered as a threatened plant (Karaw) according to the Red list 2012. Endemic plant species were not recorded at the project site. (Table 3.2.2B). One endemic mammal species (Sri Lanka toque monkey) were recorded from the area.

**Table 3.2.2B:** Threatened plant species recorded from the project area.

Family	Species	Local Name	HA	TS	CS
Phyllanthaceae	<i>Magaritaria indica</i>	Karaw	T	N	VU
Cercopithecidae	<i>Macaca sinica</i>	Sri Lanka toque monkey (Rilawa)		E	

**Abbreviations:** HA – Habit, T – Tree, S – Shrub; TS- Taxonomic status, N- Indigenous, E- Endemic, CS- Conservation Status, VU- Vulnerable

### **3.3. Human Settlement and Land Use**

#### **3.3.1 Distances to the Nearest Sensitive Structures such as Residences or Settlements, Hospitals, Schools, Public Buildings or Places of Worship**

##### **Settlements Situated in the Close Vicinity**

The proposed graphite mining site is located in the hilly area of the Kotuhena village of the Kotuhena Grama Niladhari Division (GND). The human settlements and other social infrastructure facilities are located in the surroundings of this proposed site for graphite mining. Based on the socio-geographical settings of the surroundings of the proposed site for the graphite mining, the area located within 500m radius from the site, has been considered as the study area, for the Sociological investigations.

The following table shows the existing human settlements situated (within 500m radius) in the close vicinity of the project location.

**Table 3.3.1:** Human Settlements in the Close Vicinity

Distance (m)	Number of Houses and other assets	Remarks
0-100	0	-
101-200	0	-
201-250	09	6 houses, a public well and 2 project owned buildings
251-300	02	All are houses
301-350	05	3 houses ,1 under construction houses and a public well
351-400	03	All are houses

401-450	03	2 houses and a storage tank of the existing community water supply scheme
451-500	02	houses
<b>Total</b>	<b>24</b>	

Source: GPS survey report, Kotuhena, Proposed Graphite Mining Project, 2020

GPS survey report shows that only 24 houses and other assets are situated within 500m radius from the project location. Furthermore, according to the above details, 18 houses and a few other private and public assets are situated within the study area. Among them 2 public wells, a storage tank of the community water supply scheme, and two project owned buildings are located within the 500m radius. No houses located within 200m radius and the closest house is located at the distance of 213m from the shaft of the proposed graphite mine. All graphite mining activities will occur underground along the graphite deposit veins. Only manual screenings and transportation is happening on the land within the project location. Therefore, no negative effects could be expected on these buildings and dwellers, etc.

### Population

The following table shows the population living the study area and its gender composition.

**Table 3.3.1A:** Gender Composition of the Population

Gender composition	Population in the impacted area (within 500m)	Population in the rest of area of the of GND	Total
Male	34	574	608
Female	38	605	643
<b>Total</b>	<b>72</b>	<b>1179</b>	<b>1251</b>

Source- Household survey, Kotuhena, March 2020

According to the household survey results, the total population in the study area (within 500m radius) is 72. Also, the above table highlights the gender composition of the population and the fact that the male population is slightly dominated by the female population.

### Types of houses

Nature of houses situated within the Kotuhena village is shown in the following table.

**Table .3.3.1B: Type of Houses**

Type of house	Number of houses	%
Permanent	03	17
Semi-permanent	13	72
Temporary	02	11
<b>Total</b>	<b>18</b>	<b>100</b>

Source- Household survey, Kotuhena, Ridigama, March 2020

The above table indicates that the majority of houses were semi-permanent (72%). Permanent houses were around 17% in the study area. The percentages of temporary houses also were in a considerable level.

**3.3.2: Identify any Sensitive Structures such as Irrigation Structures, Dams, Historical Buildings, Monuments of Special Values or Significance within 1km Radius. This should be marked in a map of 1:10.000 scale**

**Table 3.3.2: Sensitive Structures Located in the Close Vicinity**

Nature of Structure	Located within 1km radius	Distance (m)
Irrigation structures such as Dams, tanks, Canals etc.,	0	-
Historically or Archeologically important places	0	-
<b>Monuments of Special Value and Other Significance</b>		
Sri Visudharma Purana Viharaya	Yes	Over 1Km
Shidda Suniyam Devalaya	yes	Over 1Km
Storage Tank and the pipe system of the existing community water supply scheme	yes	Over 417m
Public well one	Yes	Over 225m
Public well two	Yes	Over 330m
Vishaka Pre School	yes	Over 1km
Hand Pump Tube well	Yes	Over 1km

Source: Field Survey, Kotuhena, Ridigama DSD, March 2020

Accordingly, no irrigation, dams, canals, or tanks, historically or archeologically important places were located close to the proposed site graphite mining and therefore no negative impacts could be identified on irrigated agriculture in the area. The dominated crop cultivated in the adjacent lands is coconut. However, all graphite mining activities occur underground along the graphite deposit veins.

Meanwhile, two public dug wells and the storage tank of the community water supply scheme are located within a 500m radius from the project location. Religious places such as Sri Vishudharma temple and the Devalaya is located over 1km away from the project location.



**Kotuhena Sidhdha Suniyam Devalaya, located over 1km distance**

No other sensitive structures such as schools, hospitals, public buildings, or other significance located close to the project location. Therefore, no negative impacts could be expected on these perennial crops during the project operations. However, if any damages occur, the affected parties should be reasonably compensated in consultation with the relevant authorities, for which the project should have an appropriate compensation package. No negative impacts could be expected on the livelihood pattern in the area, but many positive impacts could be created through new employment opportunities and related economic activities during the project operation period.



**The Temple and the Pre School located over 1km distance**

**Fig. 3.3.2:** 1:10,000 Scale Map Showing Identified Structures within 1km Radius

### **3.3.3: Identify the Existing Practices of Meeting the Water Demand for Domestic and Agricultural Needs in the Study Area**

#### **Use of Water for Domestic Purpose**

The following table gives details of the existing domestic water supply facilities and their usage patterns in the proposed project area.

**Table 2.3.3: Type of Water Sources and their Usage**

<b>Type of Water Sources</b>	<b>Number of House Holds</b>	<b>%</b>
Public dug well -one	07	39
Public dug well-Two	08	44
Hand Pump Tub well	03	17
<b>Total</b>	<b>18</b>	<b>100</b>

Sources: Household Survey, Kotuhena, March 2020

According to the above table, 83% of inhabitants are still using the unprotected dug wells as water sources for their drinking and cooking purposes. Among them, 39% and 44% dwellers are using public dug well one and two, respectively. The rest of them are using Hand Pup Tube well located at the start point of the village. During the study, I was observed that a community water supply scheme has been constructed by World Vision Lanka (A non-government organization) and it is in the process of commissioning. After commissioned this community water supply scheme all dwellers of the study area will be benefited by connecting to the pipe network to fulfill their domestic water requirement. Therefore, no disturbance is expected on the existing domestic water supply facilities due to the project.



**Public well – one located in the vicinity**



**Storage Tank of the Community Water Supply Scheme**

#### **Use of Water for Bathing Purposes**

Meanwhile, the majority of inhabitants are using existing wells for bathing and washing purposes. After commissioning of the commissioned of the newly constructed community water supply scheme all inhabitants would be benefited through piped water supply for their doorsteps.

#### **Use of Water for Agriculture Purposes**

The proposed location for the graphite mines is located in the hilly area and therefore the human settlements and the lands belong to the dwellers also located surroundings of the project location. Due to the absence of water for agriculture, the dwellers do not use their domestic lands for agriculture purposes. The home gardens of the dwellers mostly contained with coconut trees and small home gardens. Hence, irrigation canals also situated far away from the proposed project area. Therefore, it cannot anticipate any negative impact on the existing agriculture activities in the area.

#### **3.3.4. If the Blasting Face is Facing any of the Following Sensitive Structures, specify the Distances. Residences or Settlements, Hospitals, Schools, Public Buildings or Places of Worship within 1km Radius**

Field survey results show that only 18 houses and home gardens are situated within 500m radius from the project location. And all graphite mining activities occur underground along the graphite deposit veins. Only manual screenings and transportation is happening on the land within the project location. The blasting face

is not facing sensitive structures such as settlements, hospitals, and schools. Public buildings, places of worship or any other important places. Because all mining activities are to be conducted underground along the graphite veins. Therefore, no blasting effects could be expected on these buildings and dwellers, etc.

## **CHAPTER - 4**

### **ANTICIPATED ENVIRONMENTAL IMPACTS**

#### **4.1 Site Preparational Impacts**

##### **4.1.1 Anticipated Impacts due to Land Clearing**

The land where the mine is to be operated is a private land and is owned by the project proponent. It is called Thalagahamulla Hen Yaya (Ratamiris Kotuwe Hena). Total extent of the land is 3.5055 ha.

Mainly man modified habitats such as home gardens, coconut plantations and secondary vegetation are identified on the ridge slope covering the proposed mine structure (Plate – 4.1.1).

By viewing the hill slope around the proposed mining site, it was appeared that some hill slope clearing activities had been performed when initiating the earlier mining activities as well as current mine preparation activities (Plate – 4.1.1). There was a possibility of uprooting few tree species within the hill slope around the mine structure during the development of mine structure in earlier days. No further uprooting of trees is required within the hill slope of the area covered by the mine structure, during the proposed mining activities.



**Plate – 4.1.1:** Photograph showing existing land use pattern immediate around the mine hill slope. Also note some land clearance activities performed around the mine hill slope

After excavating the hill slope, the company has erected a retaining wall covering only the disturbed left hill slope in order to strengthen it (Plate – 4.1.1). In this way it is recommended to erect a retaining wall covering the right hill slope as well in order to strengthen it.

RS Mines Pvt Ltd. had initially obtained an Artisanal Mining License (AML - A) (Annex – 1.1) from the GSMB in 2009 to commence mining activities in the abandoned Queen’s mine.

Soon after obtaining the mining license, the company had initiated mining activities as per the given guidelines in the mining license, covering the abandoned Queen’s mine. So, the company had initially began cleaning the abandoned shafts and adits of Queen’s mine complex and continued mining activities up to 25m depth below the surface.

When commencing mining activities, the company has cleared the hilly ground area around the mouth of the mine structure. During the cleaning process, the company had prepared a horizontal ground area in front of the mine mouth by excavating the ridge slope, in order to temporarily stockpile mined out graphite fragments, to separate graphite lumps from blasted rock fragments by manual chipping and to keep graphite veins bearing rock fragments until graphite lumps are separated by manual chipping (Plate – 4.1.1A).



**Plate – 4.1.1A:** Horizontal ground area prepared in front of the mine entrance as stockpiling sites

Proposed stockpiling sites are selected in front of the mine entrance. During earlier mining activities as well as recent exploration activities, substantial area has been prepared to stockpile mined out graphite fragments, to separate graphite lumps from blasted rock fragments by manual chipping and to keep graphite veins bearing rock fragments until graphite lumps are separated by manual chipping. In addition, these stockpiling areas are expected to be enlarged by cutting right hill slope. Hence, soil erosion process could be expected from these cut slope sections as well as soil exposed sections. Hence, it is recommended to level / slope (in 1:4 ratio) and grass turfed covering the boundary sections of these sites in order to cover these soil exposed sections.

During the establishment of office and workshop, some land clearing process had also been performed. Hence, some ground sections covering these structures had been exposed. Therefore, some soil erosion process could be expected from these soil exposed sections. Hence, it is recommended to level / slope (in 1:4 ratio) and grass turfed in order to cover these soil exposed sections.

In addition, about 5m high retaining wall is also to be established, covering the proposed boundary of waste rocks dumping site. In addition, a retaining wall section has also to be erected within the right hill slope, bordering the stockpiling site. During the establishment of both these retaining walls, hill slope will have to be disturbed along the path of the retaining wall in order to put down its foundation.

Furthermore, in order to erect built-up drain system covering the project area (Refer Fig. 4.1.1), minor earth moving activities are needed on the ground surface of the downward hill slope. The excavated soils will be used for level these sites. Blasted rock fragments will be used for erection of retaining walls covering downward slopes of mine graphite stockpiling site,

After erecting built-up drain system and retaining walls covering the downward slopes of these structures, all the soil exposed sections will be grass turfed in order to avoid soil erosion from the disturbed sections of the downward hill slope.

In order to control soil erosion and slope stabilizing in the area bordering the shaft mouth, shotcreting will be done (Fig. 4.1.1).

#### **4.1.2 Impacts due to Establishment of Mine, Adits / Shafts**

During the exploration program, old mine structures (3 adits and 2 shaft structures) have been cleaned by removing debris materials dumped into the structures when the mine was abandoned and also debris materials fallen into these

mine structures due to collapsing of soil overburden cover / weathered rocks. All these debris materials had been removed during exploration program and dumped in the area covered by the selected waste rocks dumping site. Of these removed dump materials, rock fragments could be used to erect proposed retaining walls while soil materials could be used for leveling the required sloppy areas of the project related sites. Retaining walls will be erected covering the outer periphery of the waste rocks dumped site.

After cleaning the abandoned mine structures, their walls were concreted up to the bed rock in order to avoid further collapsing the side walls of shaft / adit structures which comprising of soil overburden cover and weathered rocks.

During the establishment of main mine structure, some land clearing process had also been performed. Hence, some ground sections covering these structures had been exposed. Therefore, some soil erosion process could be expected from these soil exposed sections. Hence, it is recommended to level / slope (in 1:4 ratio) and grass turfed in order to cover these soil exposed sections.

In addition, when establishing mine graphite stockpiling site, waste rocks dumping site, soil dumping site and vehicle parking area, some ground sections will have to be exposed. Hence, soil erosion process could be expected from the soil exposed boundary sections of these sites. Hence, it is recommended to level / slope (in 1:4 ratio) and grass turfed covering the boundary sections of these sites in order to cover these soil exposed sections.

Mouths of two adit structures have been identified along the downward slope. Currently, mouths of these adit structures have been filled with debris soil materials, during its closure period. During establishment period, all the debris materials filled within both adit structures will be removed and dumped within the identified soil dumping site which is proposed near to the adit mouths. In order to avoid eroding the dumped soil materials, a retaining wall will be erected in the downward slope section of the proposed soil dumping area.

In addition to development of main shaft and adit structures, stockpiling sites, waste rocks dumping sites, concrete drains will have to be constructed at the site. After erecting these structures, all the soil exposed disturbed sections will be grass turfed in order to avoid soil erosion from the disturbed sections of the downward hill slope

#### **4.1.3. Impacts on Natural Drainage Pattern and Hydrology of the Area**

#### **4.1.4. Potential Traffic, Noise and Air Quality Impacts**

Initial site preparational activities i.e., clearing the vegetation around the abandoned site area, erection of stockpiling sites, waste rocks dumping site, rehabilitation of the old mine structures (3 adits and 2 shafts) by cleaning, strengthening, and concreting have already been completed.

Balance work left in the site preparational work is the erection of side drains, concrete drains, silt traps, waste rocks dumping site, etc. In addition, some development to the existing access road section from Kotuhena Junction to the project office and from project office to the mine structure are needed.

When performing the balance work, some limited dust and noise will be created due to the operation of limited machineries and a few vehicle movements.

During the balance site preparation activities, there will not be many vehicles involved. There is a dead end to the road leading the proposed project site. Therefore, there is no through traffic. Therefore, noise created due to vehicle movement will be negligible.

Similarly, only few machineries will be in operation within the limited periods during erection of side drains, concrete drains, silt traps, waste rocks dumping site, and development of access road sections. When considering the operation of limited machineries during this balance site preparational work, some noise will be created. However, magnitude of the creating noise is low and hence the total created noise could be considered as negligible.

#### **4.1.5. Proposed Mitigatory Measures**

The following mitigatory measures are recommended in order to minimize the impact on natural drainage pattern and hydrology of the area due to the site preparation activities.

- The removed overburden materials are proposed to dump to the allocated area as per the Figure - 2.4.2 to control the adding of fine materials to the drainage paths.

- Silt traps with concrete drains are proposed to construct at given places to avoid movement of fine materials and contaminants to the streams during the rainy period (Fig. 2.4.2).

## 4.2. **Operational Impacts**

### 4.2.1. **Land**

#### 4.2.1.1 **Impacts on Land Stability due to Mine**

Thickness of the overburden cover on the top of the project area varies from 0 – 5m and it comprises of orange, brown lateritic soil cover (Plate – 4.2.1.1) and residual soil cover & highly to completely weathered rock formation of garnetiferous quartzofeldspathic gneiss and charnockitic gneiss rocks. At places dumped rock boulders during previous graphite mining activities are also identified (Plate – 4.2.1.1a). At some places of the hill slope, unstable rock boulders exit. Hence, it is highly recommended to remove such boulders, prior to commencement of the mine with the advice of an experienced landslide specialist.



**Plate – 4.2.1.1:** Orange brown lateritic overburden soil cover within the project area



**Plate – 4.2.1.1a:** Presence of dumped rock boulders during previous graphite mining activities at places on the top of the overburden cover

Only minor disturbances were made to the overburden cover during preparation of project related structures and stockpiling areas.

During the previous development of private access road, leading to the mine entrance, hill slope embankment had been disturbed upto 3m height. As a result, minor slope collapsing was occurred at the roadside slope embankment (Plate – 4.2.1.1b)



**Plate – 4.2.1.1b:** Minor collapsing of roadside slope embankment at place along the access road

Hence, it is highly recommended to shape the roadside slope embankments with more than 2m height in 1:4 ratio and allow to grow fast growing plants on the slope in order to control minor roadside slope collapsing.

In addition, during previous mining activities, overburden cover on the hill slope around the mine entrance had also been disturbed to some extent up to the bed rock level (Plate – 4.2.1.1c) in order to open up the mine entrance.

However, under this project, removal of overburden cover would not be required. Instead, adits / shafts structures of the abandoned mine were cleaned by removing the dumped and collapsed overburden materials, during the cleaning process of the mine.



**Plate – 4.2.1.1c:** Overburden cover on the hill slope around the mine entrance had been disturbed to some extent up to the bed rock level

During the recommencement of mining activities, abandoned underground adit and shaft structures will only have to be extended from the respective terminated depths. Hence, when recommencing mining activities, there is no requirement to disturb the overburden cover, as mining activities are to be conducted only in the underground, by extending abandoned adit and shaft structures by blasting the parent rock.

Since all the proposed mining activities are to be extended by developing adit and shaft structures from the already erected shaft structures, overburden cover in the rest of the project area would not be required to disturb.

Hence, surface stability related issues would not be expected due to the recommencement of underground mining activities.

However, it is highly recommended to follow the recommendations made by the NBRO (Annex – 2.4.8).

Please Refer Detailed Landslide Investigation Report in Annex – 2.4.8.

**4.2.1.2. Impacts on Buildings / Settlements (if any) Assessed due to Mining Activity using Appropriate Method (It is Advisable to Establish Baseline Conditions in this Regard)**

In order to assess any impacts on Buildings / Settlements due to mining activities, a baseline data was gathered by conducting a GPS Survey / Pre Crack Survey on

existing buildings. Baseline details of the GPS Survey / Pre Crack Survey on existing buildings are given in Annex – 4.2.1.2.

#### **4.2.2. Water**

##### **4.2.2.1. Obstruction of Natural Water Ways**

##### **4.2.2.2 Possible Contamination of Surface and Groundwater**

##### **4.2.2.3. Any depletion of Surface and Groundwater (Suitable Locations for Monitoring Wells will be Identified and Establish Baseline Conditions) and (Report from the Water Resource Board will be Obtained)**

##### **4.2.2.4. Proposed Excavated Water Discharge Method or Recharge Method**

#### **4.2.3.5 Proposed Mitigatory measures**

#### **4.2.3. Noise and Vibration**

##### **4.2.3.1. Sources of Noise Generation**

##### **a. Traffic**

Sorted out graphite will be transported out to Processing plant to be located around Kurunegala in 2 ton trucks.

Monthly transport will be about 50 tons up to 5 years and reach 100 tons after 7 years and 200 tons a month after 10 years. 200 tons per month means about 8 tons a day for 25 days. It will need 4 trucks a day to leave the site.

Frequency of rolling traffic - maximum 4 trucks in and out per day when the mine is in full operation

Operating hour allowed of such rolling traffic - 06:00 hr to 18:00 hr

Road traffic to / from the site will be minimal due to the somewhat small nature of the operations and limited crew. It is anticipated that generally traffic would be limited to start and end of each day's work with a few employee's transport / travelling vehicles and occasional service / stores vehicles.

**b. Machinery**

- Jack hammers
- Air compressor
- Generator
- Main ventilation fans
- Operating time of above machinery – 06:00hr to 18:00hr
- Crushing /processing is not done within the site premises

As the majority of work will be undertaken underground, the impact of noise will be minimal to the surrounding environment. Surface facilities will consist of small office / container warehouse with the majority of noise potential coming from onsite compressor and generator. Both the generator and compressor will be in noise suppressed enclosures and situated in a position within the compound so further shielding is provided by the office. It is anticipated the compressor will only have intermittent use when drilling operations are undertaken. The generator will be used initially as power for the slurry pump / compressor and mine hoist, eventually reticulated s phase power will supply the site with the generator on standby.

Company intends to fit PV solar cells and battery storage onsite that will contribute to reducing the energy footprint of the operation. It is anticipated the power stored will be capable of providing green power to the office / workshop and run clean water pumps underground overnight therefore making the worksite a green energy producer.

Noise from blasting will be minimal due to small blast patterns and all operations occurring underground.

**4.2.3.2. Impacts and Mitigatory Measures due to Noise and Vibration**

Expected noise level in  $L_{Aeq,T}$  due to drilling activities may increase up to around 80 to 115 dB(A). This would cause workers in the mine exposed to high noise levels. World Health Organization (WHO) has set 85 dB as their maximum exposure limit in the workplace. Above this level, hearing protection will be worn. Therefore, ear plugs will be provided for all underground workers.

Special mitigatory measures will not be required to control noise because limited

number of machinery and vehicles are being used for the site activities. Also, the stationary machines are driven by electric power and are silent. However, every possible attempt will be taken to minimize the generated noise from the limited number of machinery and vehicles being used by keeping them in good working order.

No work will be carried at nighttime which makes noise over 45 dB. Also, the surrounding vegetation cover acts as a natural noise barrier to the site and therefore it will not be disturbed.

Main harms that arise due to ground vibration are damage to the surrounding structures especially by generation of new cracks and propagation of existing cracks on the buildings. Vibration effect depends on the category of the structure of the building. According to ISO 4866: 1990E standard, four types of buildings can be identified. Most of the houses in this area belong to type 3. Floor cracks, wall cracks could already be identified on them. Maximum permissible ground vibration level due to Multi bore hole blasting for type 3 category buildings is 5mm/sec in PPV.

To identify ground vibration level that affect those places, will monitor the vibration level randomly.

Pre structural survey (crack survey) for all the buildings covering 600m radius of the shaft structure has already been done.

Also post structural survey (crack survey) will be done for all the buildings within the minimum radius of 600m from the blasting area. After considering the effects of ground vibration and comparing both pre and post crack survey relevant to each building, necessary arrangements will be taken to repair the generated cracks on the buildings.

Explosive type and weight, delay-timing variations, size and number of holes, bore hole pattern, distance between holes and rows (Spacing and Burden), method and direction of blast initiation, Distance from blast to point of concern (house, tank, etc.), geology and overburden are the most important factors which affect ground vibrations from rock blasting.

The distance from the blast to the point of concern cannot be controlled. But other parameters can be controlled. Therefore, proper blasting along with controlling every possible factor to minimize the ground vibration, will be designed with the consultancy of GSMB and CEA. All the restrictions and limitations enforced by CEA, GSMB or any other regulating authority will strictly be followed, ensuring the environment friendly nature of the project.

Also, every blast will be carried out only under the supervision of qualified Mining Engineers with relevant work experience

#### **4.2.4. Air**

##### **4.2.4.1. Air Quality Impacts from Traffic**

Few vehicles are used for site purpose (i.e., cab and jeep, dump truck/light truck). During operation of diesel or petrol driven above vehicles, due to imperfect combustion, few amount of CO, SO<sub>2</sub>, oxides of Nitrogen (NO<sub>x</sub>) would be released to the atmosphere.

Therefore, those gases will be immediately dilute into the environment. However, all are kept in good condition to maintain gas emission at acceptable levels.

##### **4.2.4.2. Air Quality Impacts from Drilling. Mining. Handling of Material and Heavy Machinery Operations**

###### **Emission due to Operation**

Drilling and blasting will be applied for the underground mine development. Gases like NO<sub>x</sub>, CO and CO<sub>2</sub> will mainly get into atmosphere together with dust during rock blasting, but drilling does not contaminate air with dust because wet drilling is normally applied for underground operations.

Only manual methods will be applied for the underground mucking and loading processes and no machines will be used for that. Therefore, gases being released from underground machines will not be applicable. But dust may be generated due to mucking and loading.

Few machines and vehicles are used for site purposes i.e., Generator, cab and jeep, dump truck/light truck. During operation of diesel or petrol driven above machinery and vehicles due to imperfect combustion, few amount of CO, SO<sub>2</sub>, oxides of Nitrogen (NO<sub>x</sub>) would be released to the atmosphere.

Some surface operations of the project i.e., maintenance of access road and internal service roads, material transportation, handling of mine waste and waste rock dumping yard may cause to accumulate some considerable amount of dust to the environment. This would be more significant during dry weather condition.

###### **Odour**

Mining is supposed to carry out for further depth. Therefore, cleaned old shafts and adits may be developed further deeper. Therefore, noxious gases such as methane and hydrogen sulfide may be encountered when the mine is opened.

Gases being released from machines and vehicles will be at minimum because small number of diesel or petrol driven machines and vehicles are used for the project works. Therefore, those gases will be immediately dilute into the environment. However, all are kept in good condition to maintain gas emission at acceptable levels.

**Impacts due to Emissions**

Air pollution can occur due to addition of substances in sufficient quantities into atmosphere; especially exhaust dust and fumes can produce harmful effects on humans and animals. Direct impact will be expected from the project workers due to exposure to dust and fumes, especially from the underground miners. Properly designed and developed ventilation system can minimize that effect. However, every worker is advised to wear dusk mask in the project site.

Existing vegetation of surrounding area which provides a good filtering effect for CO<sub>2</sub> and dust will not be disturbed. Also, the surrounding inhabitant is located more than 150m distance from the project. Therefore, effect for that area will be very minimum.

Some of the effects of air pollution are shown in Table - 4.3.4.3

**Table - 4.2.4.3: Effect of Air Pollution**

<b>Pollutant</b>	<b>Effects</b>	<b>First aid</b>
<b>Oxygen (O<sub>2</sub>)</b>	Oxygen deficiency Below 17%-panting, Below 15%-dizziness Below 9%-collapse, Below 7%-death	Move victim to fresh air. Perform artificial respiration if needed.
<b>Carbon Dioxide (CO<sub>2</sub>)</b>	Concentrations of 5% can produce shortness of breath and headaches. Concentrations of 10% can produce death due to oxygen deficiency.	Move victim to fresh air. Perform artificial respiration if needed.
	Reacts in the atmosphere to form acid rain.	
<b>Methane (CH<sub>4</sub>)</b>	Oxygen deficiency	Move victim to fresh air. Perform artificial respiration if needed.
<b>Carbon Monoxide (CO)</b>	Low concentrations can produce headache, dizziness, and drowsiness. Higher concentrations can produce nausea, vomiting, collapse, coma, and death.	Move victim to fresh air. Perform artificial respiration if needed.

<b>Sulfur Dioxide (SO<sub>2</sub>)</b>	Respiratory irritation. Corneal burns.	Irrigate eyes immediately. Flush skin with water. Move victim to fresh air. Perform artificial respiration if needed.
	Reacts in the atmosphere to form acid rain.	
<b>Nitrogen Dioxide (NO<sub>2</sub>)</b>	Gas can irritate eyes and mucous membranes and cause pulmonary irritation. Extremely corrosive when inhaled – cause severe burns to skin, eyes, and mucous membranes.	Irrigate eyes immediately. Flush skin with water. Move victim to fresh air. Perform artificial respiration if needed. If swallowed, get medical help, give large amounts of water - do not induce vomiting
	Reacts in the atmosphere to form ozone and acid rain	
<b>Nitric Oxide (NO)</b>	Irritation of eyes, nose, and throat. Drowsiness and unconsciousness.	Move victim to fresh air. Perform artificial respiration if needed.
	Reacts in the atmosphere to form ozone and acid rain	
<b>Hydrogen Sulfide (H<sub>2</sub>S)</b>	Irritation of eyes and respiratory tract. Acute exposure may cause immediate coma and rapid death from respiratory paralysis.	Irrigate eyes immediately. Flush skin with water. Move victim to fresh air. Perform artificial respiration if needed.
<b>Respirable Particulata Matter (PM10)</b>	Increased Respiratory Disease, Lung Damage, Cancer, Premature Death, Reduced Visibility,	
	Surface Soiling	

<b>Fine Particulate Matter (PM 2.5)</b>	Increases Respiratory Disease, Lung Damage, Cancer, Premature Death, Reduced Visibility,	
	Surface Soiling	

**4.3. Impacts on Ecological Resources**

**Impacts on Flora and Existing Habitats**

The graphite mine is not in operation for the last seven decades. The habitats in the surrounding areas are mainly man modified habitats such as home gardens, coconut plantations and secondary vegetation. The threatened plant species (Karaw) that are found in the area is also found in the secondary vegetation in the project site. Most of the project activities would take place underground. Therefore, the impacts are negligible for above ground vegetation. Few buildings and access roads would be constructed for the project activities. These aboveground structures and activities will have some adverse impacts on fauna and flora and their habitats during the operational phase. The natural habitats are not found within the project site. Some of the plant and animal species recorded from these habitats commonly found in the adjacent areas of the project and therefore plant and animal populations would not have detrimental impacts due to the operation of the project. The proposed project area will not intersect or blocks any wildlife corridors or recorded animal movement pathways. Wetlands of international importance are not located in the project area. Habitat and/ or breeding area for rare and endangered plant species or wild races of crop plants are not found in the project site. Aquatic ecosystems, such as swamps and marshes are also not found.

Once the project activities are completed the replanting/ reforestation with indigenous tree species would be recommended as a mitigatory measure to restore the habitats found in the area.

**4.4. Human, Economic and Socio-Economic Impacts**

These kinds of projects will help to improve the economy of local communities and surrounding townships as well. The following discussion shows some socio- economic developments in the area due to this project. The proposed project is not new to this area. This activity has been going to this area for over one hundred years. The famous Kahatagaha graphite Minnie is located in the adjoining area. However, people who have been directly involved in and who have experience in the activity are no longer among the living. Their second and third generations are living in the area. They have some idea about the activity acquired through folklore and

from their elders. Still, some physical observations could be made around ancient mines in this area. This analysis is based on historical evidence and existing conditions.

#### **4.4.1. Impacts on Population and Communities (Number of Families which would be Affected by Quarry Operations)**

Field survey results show that only 18 houses and home gardens are situated within 500m radius from the project location. And all graphite mining activities occur underground along the graphite deposit veins. Only manual screenings and transportation is happening on the land within the project location. Therefore, no negative effects could be expected on these buildings and dwellers, etc.

#### **Socio- cultural impacts due to migratory workers**

During the project operation period, it will need more skilled and unskilled workers. Migratory workers will be involved in implementation and operation activities. They will stay within the surrounding village or temporarily constructed accommodations within the project premises. There is a possibility to increase alcoholism within the area and the impact of that related social issues may be created. Besides, migratory workers could get involved in clandestine relationships with the ladies in the area, creating problems and conflict between the villagers and migratory workers. Therefore, the project proponent has been given his consent to consider this situation and take action to avoid such things.

#### **4.4.2. Impact on Community due to Increases of Vehicle Movement Frequency**

The existing access road from the village to the proposed string and shorting site is a narrow concrete road. This road will be used by the project only for the transportation of graphite from the project location to Colombo and the visits by officials /works to the site. Therefore, the vehicle movement frequency will not be impacted drastically to increases the traffic on this road. However, the client should have a package of compensation to develop the road and ripper the road if occur any damages. Also, it is needed to maintain the access road throughout the project operation period with the consultation of the Ridigama Pradeshiya Sabha. Besides the access road from the main shaft of the mine to the stockpile is located within the project owned premises, away from the settlements and other community assets.

#### **4.4.3. Impacts on Existing Land Uses and Planned Land Use**

All graphite mining activities will occur underground along the graphite deposit veins. Only manual screenings, separations, storing and transportation will be happening within the project owned land within the project location. The project has planned to

use the existing shafts of mines for graphite mining. Therefore, it would not expect the change of the existing land uses or planned land uses due to this project.

#### **4.4.4. Impacts on Agriculture and Live Hood Impacts**

No irrigation canals or tanks were located close to the proposed site and therefore no negative impacts could be identified on irrigated agriculture in the area. The dominated crop cultivated in the adjacent lands is coconut. However, all graphite mining activities occur underground along the graphite deposit veins. Therefore, no negative impacts could be expected on these perennial crops during the project operations. However, if any damages occur, the affected parties should be reasonably compensated in consultation with the relevant authorities, for which the project should have an appropriate compensation package. No negative impacts could be expected on the livelihood pattern in the area, but many positive impacts could be created through new employment opportunities and related economic activities during the project operation period.

#### **4.4.5. Impacts on Historical Sites and Sites of Special Value and Socio-Economic and Cultural Impacts**

##### **Impacts on Historical and Archeological Sites**

As discussed under chapter three, no important places such as culturally, socially, historically, or archeologically are situated within 1km radius from the graphite mining project location. Therefore, no negative impacts could be expected on said important places in the area

#### **4.5.6. Health Impacts**

##### **Safety Measures for Workers**

During the project operation, there is a possibility of occurring accidents, especially in underground mining, if proper and standard safety measures are not used by the workers. Meanwhile, during the field investigations, it was observed that necessary safety measures and systems had been arranged for the initial preparatory works of the project by the project proponent. However, the proponent should improve the mechanism further by introducing modern and accurate safety.

##### **Mosquito Breeding Points**

Due to the earth's work on the land surface for the preparation of sites for stockpiles, separation, and storing, some small water stagnation points could be created on the land surface during the project operation. Then there is a possibility of creating mosquito breeding points. Perhaps, this situation will create epidemics by diseases such as Malaria, Dengue, etc. Therefore, the project proponent should consider this

issue seriously and take the necessary action to avoid it. The client will have a regular mechanism with a continuous process to avoid the creation of mosquito breeding points. The project proponent will consider this issue seriously and take necessary action. Except for this issue, no other health effects can be expected by the new project.

### **Adhere to the COVID 19 Preventive Measures**

The project proponent agreed to implement the standard preventive measures to prevent from COVID 19, when the project is in preparation and operation. The project proponent will be arranging awareness programs and preventive measures at the site by consultation of the Public Health Inspector of the area.

#### **4.5. Hazardous Waste (if Any)**

#### **4.6. Other Impacts**

##### **4.6.1. Drainage**

##### **4.6.2. Pipelines**

##### **4.6.3. Transmission**

#### **4.7. Rehabilitation and Restoration Procedure**

##### **Mine Restoration Plan**

The mining operations provide for the rehabilitation of the affected land area in harmony with the existing landforms. At the completion of operations, company will remove all equipment and dismantle and remove the headframe. The adit opening will be barricaded with a suitable steel structure to ensure there can be no accidental entry. All surrounding ground will be rehabilitated back to its previous use, in this case suitable for plantation operations such as home garden.

##### **Detailed Mine Restoration Plan**

Company will develop a detailed mine restoration plan that will deal with all anticipated requirements as detailed but not limited to the following areas:

- All mine entrances worked will be capped in a way to protect from any accidental entrance.
- Tailings and waste areas will be minimal due to the expected mining technique however any tailings will be returned to the shaft area or contoured to fit in with the surrounding land area.
- Company to establish what re-vegetation is required, as the footprint is small and surrounding lands are plantation this may consist of contouring and planting coconut trees.

##### **Tailings Accumulated from Mine**

Any silt or fine material accumulated from underground mine tailings will be minimal due to the general cut and fill mining techniques planned. During refurbishment and development small quantities of mine waste may be dumped in close proximity to the shaft. The majority of this blasted material will be hard in nature with any fine material attached to the gangue which may be washed off due to rain will be collected in a sump. The sump will be periodically cleaned to ensure sufficient capacity for collection of any future fines.

##### **Materials Required for Rehabilitation**

Cut and fill method will be applied during the graphite mining process at Kotuhena mine. After a blast, pure graphite fragments and graphite bearing rock fragments are collected and are loaded into rail mounted trolleys and hauled along railway lines to the shaft where it is hoisted to the surface. Separated graphite fragments will be stockpiled within the mined graphite stockpiling site. Waste rock fragments accumulated at the ground surface, after graphite is separated out, will be dumped systematically in the waste rocks dumping site without allowing falling.

Since the cut and fill method will be applied in the mine, after a blast, graphite free blasted out rock fragments are filled in the blasted out additional void space, keeping adequate space to extend the mining activities along the adit structure.

When mining project is completed, only unfilled area left, will be shaft, tunnels, and drives. Tunnels and drives are well secured with timber, concrete struts together with rock bolts.

After completing mining activities, the shaft opening will be completely sealed using steel plates and steel plates will be locked. This is done to facilitate reopening of the mine in future by any interested party when the graphite prices increase. Like many old graphite mines are reopened today, this mine also may be reopened to recover low grade graphite. Therefore, it is not prudent to close tunnels, drives and shaft completely. Whereas shaft mouth is closed to prevent people and animals falling into it. In addition, main shaft area will also be barricaded with a permanent fence.

When extending the adit structure/s, if any adit structure/s are connected to ground surface during mining activities, such adit opening/s will also be sealed with steel plates and barricaded with permanent fence.

Therefore, additional soil / rock materials are not needed for mined pit rehabilitation process.

## **CHAPTER - 5**

### **PROPOSED MITIGATORY MEASURES**

#### **5.1.1. Proposed Mitigatory Measures to Control Land Stability Related Impacts**

Thickness of the overburden cover on the top of the project area varies from 0 – 5m and it comprises of orange, brown lateritic soil cover (Plate – 5.1.1) and residual soil cover & highly to completely weathered rock formation of garnetiferous quartzofeldspathic gneiss and charnockitic gneiss rocks. At places dumped rock boulders during previous graphite mining activities are also identified (Plate - 5.1.1a). At some places of the hill slope, unstable rock boulders exit. Hence, it is highly recommended to remove such boulders, prior to commencement of the mine with the advice of an experienced landslide specialist.



**Plate – 5.1.1:** Orange brown lateritic overburden soil cover within the project area



**Plate – 5.1.1a:** Presence of dumped rock boulders during previous graphite mining activities at places on the top of the overburden cover

Only minor disturbances were made to the overburden cover during preparation of project related structures and stockpiling areas.

During the previous development of private access road, leading to the mine entrance, hill slope embankment had been disturbed up to 3m height. As a result, minor slope collapsing was occurred at the roadside slope embankment (Plate – 5.1.1b)



**Plate – 5.1.1b:** Minor collapsing of roadside slope embankment at place along the access road

Hence, it is highly recommended to shape the roadside slope embankments with more than 2m height in 1:4 ratio and allow to grow fast growing plants on the slope in order to control minor roadside slope collapsing.

In addition, during previous mining activities, overburden cover on the hill slope around the mine entrance had also been disturbed to some extent up to the bed rock level (Plate – 5.1.1c) in order to open up the mine entrance.

However, under this project, removal of overburden cover would not be required. Instead, adits / shafts structures of the abandoned mine were cleaned by removing the dumped and collapsed overburden materials, during the cleaning process of the mine.



**Plate – 5.1.1c:** Overburden cover on the hill slope around the mine entrance had been disturbed to some extent up to the bed rock level

During the recommencement of mining activities, abandoned underground adit and shaft structures will only have to be extended from the respective terminated depths. Hence, when recommencing mining activities, there is no requirement to disturb the overburden cover, as mining activities are to be conducted only in the underground, by extending abandoned adit and shaft structures by blasting the parent rock.

Since all the proposed mining activities are to be extended by developing adit and shaft structures from the already erected shaft structures, overburden cover in the rest of the project area would not be required to disturb.

Hence, surface stability related issues would not be expected due to the recommencement of underground mining activities.

However, it is highly recommended to follow the recommendations made by the NBRO (Annex – 2.4.8).

Impacts on Land Stability and proposed mitigatory measures to control land stability related impacts are discussed in Annex – 2.4.8 (NBRO Report).

### **5.1.2. Proposed Mitigatory Measures to Control Soil Erosion & Surface Runoff Related Impacts**

The land where the mine is to be operated is a private land and is owned by the project proponent. It is called Thalagahamulla Hen Yaya (Ratamiris Kotuwe Hena). Total extent of the land is 3.5055 ha.

Mainly man modified habitats such as home gardens, coconut plantations and secondary vegetation are identified on the ridge slope covering the proposed mine structure (Plate – 5.1.2).

By viewing the hill slope around the proposed mining site, it was appeared that some hill slope clearing activities had been performed when initiating the earlier mining activities as well as current mine preparation activities (Plate – 5.1.2). There was a possibility of uprooting few tree species within the hill slope around the mine structure during the development of mine structure in earlier days. No further uprooting of trees is required within the hill slope of the area covered by the mine structure, during the proposed mining activities.



**Plate – 5.1.2:** Photograph showing existing land use pattern immediate around the mine hill slope. Also note some land clearance activities performed around the mine hill slope

After excavating the hill slope, the company has erected a retaining wall covering only the disturbed left hill slope in order to strengthen it (Plate – 5.1.2). In this way it is recommended to erect a retaining wall covering the right hill slope as well in order to strengthen it.

RS Mines Pvt Ltd. had initially obtained an Artisanal Mining License (AML - A) (Annex – 1.1) from the GSMB in 2009 to commence mining activities in the abandoned Queen’s mine.

Soon after obtaining the mining license, the company had initiated mining activities as per the given guidelines in the mining license, covering the abandoned Queen’s mine. So, the company had initially began cleaning the abandoned shafts and adits of Queen’s mine complex and continued mining activities up to 25m depth below the surface.

When commencing mining activities, the company has cleared the hilly ground area around the mouth of the mine structure. During the cleaning process, the company had prepared a horizontal ground area in front of the mine mouth by excavating the ridge slope, in order to temporally stockpile mined out graphite fragments, to separate graphite lumps from blasted rock fragments by manual chipping and to keep graphite veins bearing rock fragments until graphite lumps are separated by manual chipping (Plate – 5.1.2A).



**Plate – 5.1.2A:** Horizontal ground area prepared in front of the mine entrance as stockpiling sites

Proposed stockpiling sites are selected in front of the mine entrance. During earlier mining activities as well as recent exploration activities, substantial area has been prepared to stockpile mined out graphite fragments, to separate graphite lumps from blasted rock fragments by manual chipping and to keep graphite veins bearing rock fragments until graphite lumps are separated by manual chipping. In addition, these stockpiling areas are expected to be enlarged by cutting right hill slope. Hence, soil erosion process could be expected from these cut slope sections as well as soil

exposed sections. Hence, it is recommended to level / slope (in 1:4 ratio) and grass turfed covering the boundary sections of these sites in order to cover these soil exposed sections.

During the establishment of office and workshop, some land clearing process had also been performed. Hence, some ground sections covering these structures had been exposed. Therefore, some soil erosion process could be expected from these soil exposed sections. Hence, it is recommended to level / slope (in 1:4 ratio) and grass turfed in order to cover these soil exposed sections.

In addition, about 5m high retaining wall is also to be established, covering the proposed boundary of waste rocks dumping site. In addition, a retaining wall section has also to be erected within the right hill slope, bordering the stockpiling site. During the establishment of both these retaining walls, hill slope will have to be disturbed along the path of the retaining wall in order to put down its foundation.

Furthermore, in order to erect built-up drain system covering the project area (Refer Fig. 5.1.2), minor earth moving activities are needed on the ground surface of the downward hill slope. The excavated soils will be used for level these sites. Blasted rock fragments will be used for erection of retaining walls covering downward slopes of mine graphite stockpiling site,

After erecting built-up drain system and retaining walls covering the downward slopes of these structures, all the soil exposed sections will be grass turfed in order to avoid soil erosion from the disturbed sections of the downward hill slope.

In order to control soil erosion and slope stabilizing in the area bordering the shaft mouth, shotcreting will be done (Fig. 5.1.2).

### **Mitigatory Measures for Impacts due to Establishment of Mine, Adits / Shafts**

During the exploration program, old mine structures (3 adits and 2 shaft structures) have been cleaned by removing debris materials dumped into the structures when the mine was abandoned and also debris materials fallen into these mine structures due to collapsing of soil overburden cover / weathered rocks. All these debris materials had been removed during exploration program and dumped in the area covered by the selected waste rocks dumping site. Of these removed dump materials, rock fragments could be used to erect proposed retaining walls while soil materials could be used for leveling the required sloppy areas of the project related sites. Retaining walls will be erected covering the outer periphery of the waste rocks dumped site.

After cleaning the abandoned mine structures, their walls were concreted up to the bed rock in order to avoid further collapsing the side walls of shaft / adit structures which comprising of soil overburden cover and weathered rocks.

During the establishment of main mine structure, some land clearing process had also been performed. Hence, some ground sections covering these structures had been exposed. Therefore, some soil erosion process could be expected from these soil exposed sections. Hence, it is recommended to level / slope (in 1:4 ratio) and grass turfed in order to cover these soil exposed sections.

In addition, when establishing mine graphite stockpiling site, waste rocks dumping site, soil dumping site and vehicle parking area, some ground sections will have to be exposed. Hence, soil erosion process could be expected from the soil exposed boundary sections of these sites. Hence, it is recommended to level / slope (in 1:4 ratio) and grass turfed covering the boundary sections of these sites in order to cover these soil exposed sections.

Mouths of two adit structures have been identified along the downward slope. Currently, mouths of these adit structures have been filled with debris soil materials, during its closure period. During establishment period, all the debris materials filled within both adit structures will be removed and dumped within the identified soil dumping site which is proposed near to the adit mouths. In order to avoid eroding the dumped soil materials, a retaining wall will be erected in the downward slope section of the proposed soil dumping area.

In addition to development of main shaft and adit structures, stockpiling sites, waste rocks dumping sites, concrete drains will have to be constructed at the site. After erecting these structures, all the soil exposed disturbed sections will be grass turfed in order to avoid soil erosion from the disturbed sections of the downward hill slope

Under this project, two stockpiling sites are proposed to stockpile and storage of mined graphite (Sites – A & B in Fig. 2.4.2) (Site – A near the office and Site – B near the entrance of mine). In addition, another 3 sites are proposed for following purposes.

- to separate graphite lumps from blasted rock fragments by manual chipping (Site – C in Fig. 2.4.2)
- to keep graphite veins bearing rock fragments until graphite are separated by manual chipping at Site – C (Site – D in Fig. 2.4.2)
- to dump waste rocks and to dispose soil materials accumulated during development of existing adit structure (Site – E in Fig. 2.4.2)

Except for bagged graphite storage site, all the other sites are located in front of the mine entrance. The bagged graphite storage site is located in about 400m away from the mine entrance at close proximity to the project office.

During rainy season, there is a possibility to wash off the finer materials from these sites and encounter soil erosion and siltation related issues. But, since built-up drainage system is proposed covering the entire project area together with 10 silt traps and contour based earth drainage pattern, these wash off finer materials will be drained along the built-up drainage paths, contour based earth drainage paths and trap within the 10 silt traps. Hence, soil erosion and siltation related issues from the hill slope covering the project area could be controlled.

It is necessary to clean up the trapped silt materials from the silt traps regularly, especially during the rainy season.

The following mitigatory measures are recommended in order to minimize the impact on natural drainage pattern and hydrology of the area due to the site preparation activities.

- The removed overburden materials are proposed to dump to the allocated area as per the Figure – 5.1.2 to control the adding of fine materials to the drainage paths.
- Silt traps with concrete drains are proposed to construct at given places to avoid movement of fine materials and contaminants to the streams during the rainy period (Fig. 5.1.2).

Proposed Drainage Management Plan is shown in Figure – 5.1.2. In order to manage the rainwater and wastewater generating from various activities of the mine, a built-up drain system will be erected along the slope boundary and middle of the ridge slope of the project site as shown in Fig. – 5.1.2. It is expected to erect about 10 silt traps within the built-up drainage system in order to control siltation related issues. Drained water through the built-up drain system and through the 10 silt traps will be further drained into the Kuda Oya stream. Finally, water in the project land and its immediate surrounding will be drained into the Deduru Oya through the Kuda Oya (Fig. 5.1.2A).

Drainage Management Plan covering the project site and its immediate surrounding is shown in Figure – 5.1.2.

**Fig. 5.1.2: Drainage Management Plan**

### **5.1.3. Proposed Mitigatory Measures to Control Ground Over Pressure and Mis-Fires**

The mitigatory measures adopted to prevent miss-fires will be as follows;

- Use of high quality explosives, blasting agents, detonators and other blasting accessories which comply with international standards.
- Adoption of proper and technically accepted standards procedures in storage and handling of explosives, blasting agents, detonators, and other blasting accessories.
- Each blow hole will be cleaned of water and fallen crushed stone by compressed air before charging.
- Each detonator will be checked and tested before charging (Maximum current allowed is not more than 10 milliamps).
- After charging, the circuit will be tested for continuity and insulation (Maximum current allowed is not more than 50 milliamps, a current of 300 milliamps may initiate the fuse head of the electric detonator).
- The minimum current assured to a charged circuit to prevent miss fires will be; for series circuits - 1.5 amperes. For parallel circuits - 0.75 Amperes per detonator
- Drilling, charging, and firing done under strict supervision of site engineer or blasting Forman.

### **5.1.4. Proposed Mitigatory Measures to Control Noise and Ground Vibration Related Impacts**

This has to be measured by conducting a test blast underground. However underground operations are not allowed until the mining license is obtained. Therefore, it is suggested to carry out a test blast after the mining license is issued and incorporate relevant guidelines to the license.

In tunneling where the highest number of explosives are used, it will be only 4-5kgs of explosives used at a time as the tunnels are small 2m x2m. This will create negligible ground vibration.

#### **Sources of Noise Generation**

##### **a. Traffic**

Sorted out graphite will be transported out to Processing plant to be located around Kurunegala in 2 ton trucks.

Monthly transport will be about 50 tons up to 5 years and reach 100 tons after 7 years and 200 tons a month after 10 years. 200 tons per month means about 8 tons a day for 25 days. It will need 4 trucks a day to leave the site.

Frequency of rolling traffic - maximum 4 trucks in and out per day when the mine is in full operation Operating

hour allowed of such rolling traffic - 06:00 hr to 18:00 hr

Road traffic to / from the site will be minimal due to the somewhat small nature of the operations and limited crew. It is anticipated that generally traffic would be limited to start and end of each day's work with a few employee's transport / travelling vehicles and occasional service / stores vehicles.

#### **b. Machinery**

- Jack hammers
- Air compressor
- Generator
- Main ventilation fans
- Operating time of above machinery – 06:00hr to 18:00hr
- Crushing /processing is not done within the site premises

As the majority of work will be undertaken underground, the impact of noise will be minimal to the surrounding environment. Surface facilities will consist of small office / container warehouse with the majority of noise potential coming from onsite compressor and generator. Both the generator and compressor will be in noise suppressed enclosures and situated in a position within the compound so further shielding is provided by the office. It is anticipated the compressor will only have intermittent use when drilling operations are undertaken. The generator will be used initially as power for the slurry pump / compressor and mine hoist, eventually reticulated 3 phase power will supply the site with the generator on standby.

Company intends to fit PV solar cells and battery storage onsite that will contribute to reducing the energy footprint of the operation. It is anticipated the power stored will be capable of providing green power to the office / workshop and run clean water pumps underground overnight therefore making the worksite a green energy producer.

Noise from blasting will be minimal due to very small blast patterns and all operations occurring underground.

## **Impacts and Mitigatory Measures due to Noise and Vibration**

Expected noise level in  $L_{Aeq,T}$  due to drilling activities may increase up to around 80 to 115 dB(A). This would cause workers in the mine exposed to high noise levels. World Health Organization (WHO) has set 85 dB as their maximum exposure limit in the workplace. Above this level, hearing protection will be worn. Therefore, ear plugs will be provided for all underground workers.

Special mitigatory measures will not be required to control noise because limited number of machinery and vehicles are being used for the site activities. Also, the stationary machines are driven by electric power and are silent. However, every possible attempt will be taken to minimize the generated noise from the limited number of machinery and vehicles being used by keeping them in good working order.

No work will be carried at nighttime which makes noise over 45 dB. Also, the surrounding vegetation cover acts as a natural noise barrier to the site and therefore it will not be disturbed.

Main harms that arise due to ground vibration are damage to the surrounding structures especially by generation of new cracks and propagation of existing cracks on the buildings. Vibration effect depends on the category of the structure of the building. According to ISO 4866: 1990E standard, four types of buildings can be identified. Most of the houses in this area belong to type 3. Floor cracks, wall cracks could already be identified on them. Maximum permissible ground vibration level due to Multi bore hole blasting for type 3 category buildings is 5mm/sec in PPV.

To identify ground vibration level that affect those places, will monitor the vibration level randomly.

Pre structural survey (crack survey) for all the buildings covering 600m radius of the shaft structure has already been done.

Also post structural survey (crack survey) will be done for all the buildings within the minimum radius of 600m from the blasting area. After considering the effects of ground vibration and comparing both pre and post crack survey relevant to each building, necessary arrangements will be taken to repair the generated cracks on the buildings.

Explosive type and weight, delay-timing variations, size, and number of holes, bore hole pattern, distance between holes and rows (Spacing and Burden), method and direction of blast initiation, Distance from blast to point of concern (house, tank, etc.),

geology and overburden are the most important factors which affect ground vibrations from rock blasting.

The distance from the blast to the point of concern cannot be controlled. But other parameters can be controlled. Therefore, proper blasting along with controlling every possible factor to minimize the ground vibration, will be designed with the consultancy of GSMB and CEA. All the restrictions and limitations enforced by CEA, GSMB or any other regulating authority will strictly be followed, ensuring the environment friendly nature of the project.

Also, every blast will be carried out only under the supervision of qualified Mining Engineers with relevant work experience

#### **5.1.4. Proposed Mitigatory Measures to Control Dust and Fumes**

Proper fan forced ventilation system which will be developed and improved with the progress of mine is to be used to provide a continuous supply of fresh air to the working faces in the mine. This ventilation system augments the natural ventilation and gives adequate fresh air to extract and or dilute dust generated from the blasting.

The broken materials are to be watered down after blasting and before starting the mucking and loading, to minimize dust due to blasting, mucking, and loading activities.

Other identified dust generating locations in surface i.e., access road, internal service roads and waste rock dumping area will be suppressed with water to minimize dust emission at least three times per day.

Existing vegetation cover of surrounding area acts as a natural dust barrier. Therefore, unnecessary removal of trees and vegetation in surrounding areas will be avoided.

#### **Wet Drilling**

The type of drill is usually a jackhammer type machine mounted on an airleg. All holes are collared with water, so the dust does not contaminate the atmosphere. An in-line oiler is connected in between the machine and the hose and injects oil into the machine by pulsing of the air to keep it lubricated.

### **Watering procedure**

Water spraying will be used to prevent dust emission from both underground and surface operations of the project. Blasting of faces, mucking, and loading will mainly generate dust from underground. Therefore, after blasting and before starting mucking and loading, water will be sprayed to broken material.

### **5.1.6. Proposed Mitigatory Measures to Control Loss of Habitats**

Species or habitat specific mitigation measures are not proposed. The plants and animal species recorded are not restricted to the project area. However, once the project activities are completed the site could be restored by planting indigenous tree and shrub species found in the project area to enhance the ecological value of the habitat. The names and life forms of indigenous plant species recorded from the area are listed in Annex – 3.2.2.

### **5.1.7. Proposed Mitigatory Measures to Control Social Concerns / Issues**

These kinds of projects will definitely help to improve economy of local communities and surrounding townships as well. The following discussion shows some expected socio economic developments in the area due this project.

#### **Increased Commerce**

The project will require manpower to implement and operate the project. It is expected to employ a considerable number of workers which in turn would provide indirect employment to boarding houses and shops. Economic status of the surrounding area will increase the income through employment benefits and related work. Therefore, commercial activities in the nearby village centers and town centers will also be increased during the project implementation. It will help to uplift their standard of living, as they will get extra income.

#### **Development of Interior Roads**

This project needs an improved road network from project area to the main roads for the transportation of the product. Therefore, the project proponent will develop and maintain the internal roads leading to the project site from the Maduragoda Junction. It would be another positive impact on the area.

#### **Anticipated Impact on the Country's Economy**

Graphite is one of the most valuable natural resources that could be exported and earn foreign exchange to the country. The country still possesses two or three functioning graphite mines. The proposed project would facilitate the country to earn more foreign exchange. Therefore, the proposed project would directly be economically beneficial and would facilitate the development of our country.

### **Socio-economic and Cultural Impacts due to Migratory Workers**

During the project operation period, it will need more skilled and unskilled workers. Definitely migratory workers will be involved in the operation activities. They will stay within the surrounding village or temporarily constructed accommodations within the project premises. There is a possibility to increase alcoholism within the area and impact of that related social issues may be created. In addition, migratory workers could get involved in clandestine relationships with the ladies in the area, creating problems and conflict between the villagers and migratory workers. Therefore, the project proponent has been given his consent consider this situation and take action to avoid such things.

### **Historical and Archeological Impacts**

As discussed under chapter three, no important places such as culturally, socially, historically, or archeologically are situated within 1km radius from the graphite mining project location. Therefore, no negative impacts could be expected on said important places in the area

### **Economic impact due to New Employment Opportunities**

It will create employment opportunities especially for skilled and unskilled labour, management, and clerical categories etc. Mining, screening, and transportation will be the main areas which will create more employment opportunities. According to the household study, considerable numbers of people are living in the area and the vicinity expecting jobs in above mentioned categories from this project. Therefore, Project proponent will have a recruitment policy which would give priority to the residents within the project area and the vicinity in recruitments for jobs. This will be a positive impact on the project area.

### **Any Impacts on Sensitive Buildings / Structures**

Following Table Describes the Sensitive Structures Identified in Close Vicinity

<b>Nature of establishment</b>	<b>Located within 1km radius</b>	<b>Distance (m)</b>
Irrigation structures such as Dams, tanks. Canals etc.,	0	-
Historically or Archeologically important places	0	-
<b>Monuments of special value and other significance</b>		
Sri Visudharma Purana Viharaya	Yes	Over 1Km
Shidda Suniyam Devalaya	yes	Over 1Km
Storage Tank and the pipe system of the existing	yes	Over 417m

community water supply scheme		
Public well one	Yes	Over 225m
Public well two	Yes	Over 330m
Vishaka Preschool	yes	Over 1km
Hand Pump Tube well	Yes	Over 1km

Source –Field survey, Kotuhena, Ridigama DSD, March 2020

Accordingly, no irrigation, dams, canals, or tanks, historically or archeologically important places were located close to the proposed site graphite mining and therefore no negative impacts could be identified on irrigated agriculture in the area. The dominated crop cultivated in the adjacent lands is coconut. However, all graphite mining activities occur underground along the graphite deposit veins.

Meanwhile, two public dug wells and the storage tank of the community water supply scheme are located within a 500m radius from the project location. Religious places such as Sri Vishudharma temple and the Devalaya is located over 1km away from the project location.

No other sensitive structures such as schools, hospitals, public buildings, or other significant structures are located close to the project location. Therefore, no negative impacts could be expected on these perennial crops during the project operations. However, if any damages occur, the affected parties should be reasonably compensated in consultation with the relevant authorities, for which the project should have an appropriate compensation package. No negative impacts could be expected on the livelihood pattern in the area, but many positive impacts could be created through new employment opportunities and related economic activities during the project operation period.

Hence, due to the above mentioned nature of project operations, no negative impacts could be expected to sensitive buildings / structures.

However, in order to assess any impacts on Buildings / Settlements due to mining activities, a baseline data was gathered by conducting a GPS Survey / Pre Crack Survey on existing buildings. Baseline details of the GPS Survey / Pre Crack Survey on existing buildings are given in Annex – 4.2.1.2.

**Health Impacts**

**Safety of Workers**

During the project operation, there is a possibility of occurring accidents, especially in underground mining, if proper and standard safety measures are not used by the workers. Meanwhile, during the field investigations, it was observed that, necessary

safety measures and systems had been arranged for initial preparatory works of the project by the project proponent. However, the proponent will improve the mechanism further by introducing modern and accurate safety.

**Mosquito Breeding Points**

Due to the earth's work on the land surface for the preparation of sites for stockpiles, separation, and storing, some small water stagnation points could be created on the land surface during the project operation. Then there is a possibility of creating mosquito breeding points. Perhaps, this situation will create epidemics by diseases such as Malaria, Dengue, etc. Therefore, the project proponent should consider this issue seriously and take the necessary action to avoid it. The client will have a regular mechanism with a continuous process to avoid the creation of mosquito breeding points. The project proponent will consider this issue seriously and take necessary action. Except for this issue, no other health effects can be expected by the new project.

**Adhere to the COVID 19 Preventive Measures**

The project proponent agreed to implement the standard preventive measures to prevent from COVID 19, when the project is in preparation and operation. The project proponent will be arranging awareness programs and preventive measures at the site by consultation of the Public Health Inspector of the area.

Proposed mitigatory measures for identified / expected above mentioned impacts are described in Table – 5.1.7.

**Table – 5.1.7: Proposed Mitigatory Measures –Sociological**

	<b>Item</b>	<b>Anticipated Impact</b>	<b>Proposed Mitigatory Measures</b>
01	Disturbances to the people	Mining effects on human settlements	Due to underground mining activities, no disturbances could be expected on human settlements.
02	Employment and Income	It will create more job opportunities when the project is in operation.	Priority should be given to the people in surrounding areas while allocating, employment opportunities.
03	Socio-cultural impacts due to migratory workers	There is a possibility to increase alcoholism within the area and impact of that related social issues may be created.	The project proponent agreed to consider this situation and take action to avoid such things by using appropriate accommodations arrangements.
04	Cultural, Historical /	No historical and archeological sites are	No negative impacts

	<b>Item</b>	<b>Anticipated Impact</b>	<b>Proposed Mitigatory Measures</b>
	Archeological Sites	found in close vicinity of the project location.	
05	Health effects (Mosquito breeding points)	Creation of water stagnation points on the land surface and there is a possibility of creating mosquito breeding points. Perhaps, this situation will create epidemics by diseases such as Malaria, Dengue etc.	The project proponent will address this issue seriously and take necessary action to avoid it. The client already agreed to formulate a regular mechanism with continuous process to avoid creating mosquito breeding points.
06	Health Impacts (COVID 19)	Possibility to spread COVID 19 among the staff/workers	The project proponent agreed to implement the standard preventive measures to prevent from COVID 19, when in the project is in preparation and operation.
07	Using village access road for transportation	Damages of road and road properties	Project proponent agreed to maintain the village access road throughout the project period with consultations of the Ridigama Pradeshiya Sabha
08	Damage to properties rarely	Damage of properties rarely or accidentally.	The project proponent will have a reasonable package of compensation for people likely to be affected rarely or accidentally.

**5.2 Proposed Compensation Measures for those Identified in Section 5.1, Including Insurance Cover**

- The project proponent can bear any reasonable financial commitment to effect compensation or related matters.
- The project proponent also undertakes to forward a bond or guarantee or/and to deposit of a reasonable amount of money in order to compensate related matters if Project approving agency and/or relevant authorities instructs to do so.

- The project proponent will extend its fullest support by means of a reasonable financial grants, material, and machinery in the case of community organizations of the area or the Pradeshiya Sabha requesting its assistance for the development of socioeconomic infrastructure in the immediate vicinity of the project site.
- For the compensation measures, the company will allocate reasonable amount of money.

### **Employment to the Dwellers in the Vicinity**

It will create employment opportunities especially for skilled and unskilled labor, management, and clerical categories, etc. Mining, screening, and transportation will be the main areas that will create more employment opportunities. The considerable numbers of people are living in the area and the vicinity expecting jobs in the above mentioned categories from this project. Therefore, Project proponent agreed to have a recruitment policy that would give priority to the residents within the project area and the vicinity in recruitments for jobs. This will be positive impacts on the project area.

### **Socio- Cultural Impacts due to Migratory Workers**

Migratory workers will be involved in implementation and operation activities. They will stay within the surrounding village or temporarily constructed accommodations within the project premises. There is a possibility to increase alcoholism within the area and the impact of that related social issues may be created. Besides, migratory workers could get involved in clandestine relationships with the ladies in the area, creating problems and conflict between the villagers and migratory workers. Therefore, the project proponent has been given his consent to consider this situation and take action to avoid such things

## **5.4 Details of Proposed Safety Precautions**

During the first year of the operation, it is highly recommended to obtain civil structural engineer's certification for the head frame and if required re-construction enabling handling loads and mining and mechanical engineers' recommendations with regard to hoisting gear, namely, hoist suitable for future man-riding as well as graphite and rock hoisting, head sheave, wire rope, coupling and installing a cage for shaft hoisting.

Mine personnel should be provided with all the basic safety gear conforming to the current norms in the industry and the management should ensure providing basic safety training to the cadre with the preparation of a safety manual to be circulated as a handbook. Safety helmets for preventing head injuries, spectacles for eye

safety, dust masks, safety shoes, safety harnesses should be provided to all the employees.

Consultants are of the view that an initial safety audit of the mine should be conducted covering all the practices and followed by consequent action to ensure practice carried out in conformity with the industry norms and standards.

Site security is of utmost importance as this is an industrial site handling explosive. Mine manager should keep under his close supervision all activities related to explosive movement records.

It is recommended to obtain the advice and guidelines of the Assistant Controller of Explosives and local police relating the storage, security and of handling of explosives and accessories.

Measures should be taken to keep the adit portal secured with string mesh-type door during non-working hours and both shaft and adit portals should be well illuminated during night-time work shifts.

If a site-located explosive storage is planned, a suitable lightning arrestor should be installed.

As regards the communication system:

- Work site contact from outside – Key personnel will be provided with mobile connectivity for outside communication.
- Underground and Surface: While retaining the “Talking-through-the-tube” system for communication between the underground and surface, a hardy wired fail-safe intercom system will be established from the shaft bottom to the top deploying a banks man at the shaft top and an on-setter at the shaft bottom.
- Introducing a bell system for shaft traffic the number of rings indicating a particular activity such as hoisting a load, hoisting, and lowering of men etc.
- In due time the management will take steps to extend the CCTV system to Underground.

In addition, following safety precautions should also have to be followed.

- a). Strict security measures will be introduced to prevent infiltration of non-employees into the site and blasting areas.
- b). Charging and associated work will be carried out in accordance with standard procedures only by a handpicked lot of reliable and dependable workers who

were given a certain training on blasting works and preventing other workers entering the blasting area and getting involved with such work.

- c). Smoking will not be allowed within the entire site.
- d). All equipment will be removed to safe locations.
- e). Testing of the charged circuit will be done only from blasting point.  
(maximum current allowed into the circuit will be 50 milliamps).
- f). Soon after the detonation the face will be checked by the Blasting Foreman for un-detonated explosives and loose rock. Upon the complete satisfaction of these officers, the face will be cleared for scaling, mucking and transport.
- g). If necessary, any other precautionary measures will be implemented on the recommendations of the GSMB, CEA

## **5.5. Rehabilitation and Restoration Procedure**

### **Mine Restoration Plan**

The mining operations provide for the rehabilitation of the affected land area in harmony with the existing landforms. At the completion of operations, company will remove all equipment and dismantle and remove the headframe. The adit opening will be barricaded with a suitable steel structure to ensure there can be no accidental entry. All surrounding ground will be rehabilitated back to its previous use, in this case suitable for plantation operations such as home garden.

### **Detailed Mine Restoration Plan**

Company will develop a detailed mine restoration plan that will deal with all anticipated requirements as detailed but not limited to the following areas:

- All mine entrances worked will be capped in a way to protect from any accidental entrance.
- Tailings and waste areas will be minimal due to the expected mining technique however any tailings will be returned to the shaft area or contoured to fit in with the surrounding land area.
- Company to establish what re-vegetation is required, as the footprint is very small and surrounding lands are plantation this may consist of contouring and planting coconut trees.

### **Tailings Accumulated from Mine**

Any silt or fine material accumulated from underground mine tailings will be minimal due to the general cut and fill mining techniques planned. During refurbishment and development small quantities of mine waste may be dumped in close proximity to the shaft. The majority of this blasted material will be hard in nature with any finematerial attached to the gangue which may be washed off due to rain will be collected in a sump. The sump will be periodically cleaned to ensure sufficient capacity for collection of any future fines.

### **Materials Required for Rehabilitation**

Cut and fill method will be applied during the graphite mining process at Kotuhena mine. After a blast, pure graphite fragments and graphite bearing rock fragments are collected and are loaded into rail mounted trolleys and hauled along railway lines to the shaft where it is hoisted to the surface. Separated graphite fragments will be stockpiled within the mined graphite stockpiling site. Waste rock fragments accumulated at the ground surface, after graphite is separated out, will be dumped systematically in the waste rocks dumping site without allowing falling.

Since the cut and fill method will be applied in the mine, after a blast, graphite free blasted out rock fragments are filled in the blasted out additional void space, keeping adequate space to extend the mining activities along the adit structure.

When mining project is completed, only unfilled area left, will be shaft, tunnels and drives. Tunnels and drives are well secured with timber, concrete struts together with rock bolts.

After completing mining activities, the shaft opening will be completely sealed using steel plates and steel plates will be locked. This is done to facilitate reopening of the mine in future by any interested party when the graphite prices increase. Like many old graphite mines are reopened today, this mine also may be reopened to recover low grade graphite. Therefore, it is not prudent to close tunnels, drives and shaft completely. Whereas shaft mouth is closed to prevent people and animals falling in to it. In addition, main shaft area will also be barricaded with a permanent fence.

When extending the adit structure/s, if any adit structure/s are connected to ground surface during mining activities, such adit opening/s will also be sealed with steel plates and barricaded with permanent fence.

Therefore, additional soil / rock materials are not needed for mined pit rehabilitation process.

## **CHAPTER - 6**

### **ENVIRONMENTAL MONITORING PROGRAMME**

Project proponent will establish an appropriate monitoring plan to ensure that the proposed mitigatory measures are properly implemented. This will enable to detect any undesirable side effects at an early stage.

The project proponent has to play leading role in facilitating environmental management of the project site. Funding for environmental management of the project site will be borne by the project proponent.

The PEA-NWP takes the leadership role in the monitoring process. The monitoring committee, of which members will be appointed by the Project Approving Agency (i.e., PEA-NWP), will consist of members from various line agencies and related local government bodies. They are skilled or authorized to evaluate the implementation of monitoring plan in the respective fields. They will monitor all the activities of project proponent's monitoring plan. Presence of a mining engineer, hydrogeologist, geologist, landslide specialist, soil scientist, ecologist, sociologist, hydrologist, and a civil engineer is a must for the monitoring team.

The project may also accommodate a public monitoring group. The group may consist of members of Community based organizations (CBO), village community leaders, village priest, village school principal, etc, The monitoring team could get views of public monitoring group during their monitoring process.

The proponent will work in collaboration with relevant government link agencies on matters related to environment management.

Methodology of the Monitoring Program is as follows.

#### **- *Monitoring Objectives***

The monitoring is carried out to achieve following main objectives.

- To ensure that mitigatory measures are implemented in conformity with the recommendations of the IEE.
- To maintain the impacts within the legal standards.

- To provide timely warning of potential environmental damages so that remedial actions can be taken before impacts result.

#### - **Phase of Monitoring**

Three main phases will be considered in the monitoring plan.

##### Pre Construction phase

Periodic Monitoring will be conducted during pre-construction stage.

##### Construction phase

Periodic monitoring will be conducted during the construction stage as well. It is advisable to instruct the Environmental Officer attached to the Ridigama Divisional Secretariat to conduct close monitoring of the project activities especially during the construction period.

##### Post Construction / Operation phase

During first year after commissioning, periodic monitoring (every two months period) is recommended. Thereafter, monitoring work is proposed to be extended for every six months period.

#### - **Types of Monitoring**

Three main types of monitoring are considered in the monitoring plan.

##### - *Baseline Monitoring*

Prior to commencing construction activities, surveys are needed to ascertain the baseline levels of environmental parameters. The values of baseline conditions may be compared with values of subsequent monitoring during the construction, operation, and post construction period to assess changes. It will be conducted in the pre-construction phase for the items for which significant impact is anticipated.

- *Impact Monitoring*

Mining, hydrogeological, geological, ecological, social, and public health impacts may be measured to understand the degree of impairment that might occur as a result of the project.

- *Compliance Monitoring*

The above mentioned impacts will be checked in view of compliance with recommendations of the Environmental Monitoring Program, national standards, and other environmental legislations.

- **Reporting**

The project proponent will prepare routine reports for example, quarterly and annual reports and special reports which may be needed, based on its work covering all the items required. The project proponent will distribute these reports to relevant state institutions.

**Role of Link Agencies**

***Provincial Environmental Authority of NW Province (PEA-NWP)***

- To ensure that the project proponent is implementing the project, as per the terms and conditions laid down by the PEA-NWP

***Ridigama Divisional Secretariat, Ridigama Pradeshiya Sabha***

- To monitor all project related construction work and to ensure that they are conducted as per the pre-specified conditions, guidelines and the project proponent does not deviate from the proposed project design.
- To ensure that all the construction work will be performed in an environmentally friendly manner.
- To ensure that when recruiting unskilled workers, priority has been given for surrounding villagers.
- To monitor ground water levels of dug wells within 500m radius of the proposed mining area periodically.

***Water Resources Board***

- To monitor ground water levels of dug wells within 500m radius of the proposed mining area periodically.

### ***National Building Research Organization***

- To ensure that the project proponent is implementing grass turfing and stone paving the disturbed hill slopes to avoid future earth slips and any type of mass movements.
- To regularly check whether any unstable hill slopes are observed within the hill slopes covering the project area and if present to propose remedial measures.

### ***Geological Survey & Mines Bureau***

- To monitor ground vibration values when blasting is conducted during mining operations and ensure that these values do not exceed the standard values at all times.
- To check whether proposed earth drains, built-up drains, contour drains and silt traps have been established, properly.
- To check whether proposed drainage management plan is implemented.
- To check whether erected silt traps are cleaned regularly.
- To monitor whether mitigatory measures mentioned in the report have been implemented to control soil erosion

### ***Agrarian Services Department, Kurunegala Regional Office***

- To monitor whether the paddy fields located at the bottom of the hill slope are silted due the project activities and to check whether the erected silt traps are functioning smoothly.

### **Monitoring Requirements**

Two types of monitoring activities are necessary.

1. Ongoing monitoring during construction and operation of the project - To be done by the project proponent with periodic monitoring by government agencies.
2. Long-term impact evaluation during project implementation - To be done by the project proponent in collaboration with relevant government link agencies.

## **ENVIRONMENTAL MONITORING PLAN**

### **1. MINING ASPECTS**

Monitoring of proposed mining operation for the disturbances to the natural environment can be successfully performed by considering the following important aspects.

- Compliance of drilling & blasting effects with allowable limits specified by regulatory authorities. e.g., ground vibrations, air blast overpressure, dust, noise, fly rocks etc.
- Drilling & blasting timing, no. of days per week, permission for public holidays etc.
- Periodical maintenance of minor road network used for rock transport.
- Periodical inspection for any structural damages to the permanent structures, residences in the area, due to mining activities. Before commencing mining, potential structures will be closely examined and photographed.

The worldwide accepted and the best proven method of technical and scientific monitoring of mine activities has a two pronged approach towards this objective:

#### **a). Self-Monitoring**

- i). The Officer-in-Charge of the mine will personally supervise all aspects related to blasting and will comply with the conditions and recommendations stipulated by CEA and GSMB.
- ii). Conducting a routine training program for mine employees associated with blasting on safety and blasting technology and for others on safety as well as on environmental impacts of the project and the measures to be implemented for its protection.
- iii). Continuous and routine monitoring of blasting by maintaining a "Blasting Logbook" and recording the following for future analysis and the improvement of the blasting practices:
  - The engineering geological properties of the face subjected to the blast (layering such as bedding, joints, fractures, degree of weathering, etc)
  - Physical location of the blast (upper bench or lower bench)
  - Blast geometry with a sketch
  - Explosive charge

- Number of delays
  - Circuit resistance
  - Environmental and weather conditions at the time of the blast
  - Yield, Fragmentation, and fly rocks
  - Vibration and air-blast
  - Back break and over-break
- iv). An internal monitoring program will be implemented under the direct supervision of the Engineer and Officer-in-Charge of the site to ensure that all aspects are being considered for the operation of the project in environmentally friendly manner as recommended by CEA, GSMB and Provincial Authority.
- v). Mine operator will make necessary arrangements to recheck the ground vibration and noise levels at predefined intervals depending on the quarry face location and its proximity to the nearest dwelling house by independent organizations

**b). Random Monitoring**

Random monitoring with on-going mining operation can be successfully carried out under the following monitoring program.

**MINING ASPECTS**

<b>No.</b>	<b>Monitoring parameter and Method of monitoring.</b>	<b>Proposed location of sampling point</b>	<b>Frequency of monitoring</b>	<b>Responsible agency/ agencies of monitoring</b>	<b>Institutional framework for mitigation of impact</b>	<b>Cost of monitoring</b>
1.	Blasting effects	Underground Mining Locations	Monthly	Monitoring Committee GSMB and PEA-NWP	Check whether the vibration levels are within the standard limits	Rs. 50,000/= per year
2.	Compliance with drilling & blasting time limitations	Underground Mining Locations	Monthly	Monitoring Committee GSMB and PEA-NWP	Check the vibration limits	Rs. 50,000/= per year
3.	Safety alert	Underground Mining Locations	Monthly	Monitoring Committee PEA-NWP, PS Village Observers Committee	Check the measures taken for safety	Rs. 50,000/= per year
4.	Road maintenance	Road Sections	Every 3 months	Monitoring Committee RDA, Pradeshiya Sabha	Check whether road maintenance work is conducted properly	Rs. 50,000/= per year

5.	Structural damages if any	Close by Houses	Weekly	Monitoring Committee GSMB and PEA-NWP	Check the damage and compare it with pre crack survey report	Rs. 75,000/= per year
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### **DUST, NOISE & VIBRATION ASPECTS**

No	Monitoring parameter and Method of monitoring.	Proposed location of sampling point	Frequency of monitoring	Responsible agency/ agencies of monitoring	Institutional framework for mitigation of impact	Cost of monitoring
1	Level of gases in underground <b>Method:</b> Using a portable gas detector.	Underground working places	At least twice per working shift	Monitoring Committee GSMB and PEA-NWP	Check whether the gas concentration of O <sub>2</sub> , CO <sub>2</sub> , CO, NO <sub>x</sub> , CH <sub>4</sub> , H <sub>2</sub> S are in acceptable levels	Rs.50,000/- per year
2	Air velocity <b>Method:</b> Using a manometer	Major air district (splits) in underground	At least twice per working shift	Monitoring Committee GSMB and PEA-NWP	Check that velocity is enough to maintain the acceptable air flow rate of 4m <sup>3</sup> /sec.	Rs.50,000/- per year
3	Concentration of dust in	Underground	At least once a	Monitoring	Check whether the	

	underground <b>Method:</b> upwind and downwind basis Using a proper dust collector	working places	month	Committee GSMB and PEA-NWP	measured concentration is in acceptable level.	Rs.50,000/- per year
4	Total air quality survey in surface level <b>Method:</b> Using suitable equipment and method for separate gases and dust	Selected locations closed to the residential area	Complain basis	Monitoring Committee GSMB and PEA-NWP	Check the changes in air quality surrounding the site	Rs.50,000/- per year
5	Ground Vibration <b>Method:</b> using seismographs	Nearest house or complained houses	Once in every 6 months/ complain basis	Monitoring Committee GSMB and PEA-NWP	Check the ground vibration level is below to 5mm/sec	Rs.50,000/- per year
6	Noise level <b>Method:</b> according to the ISO 1996 or BS 4142:1997 using type 1 or type 2 noise meters	Boundary of the project site	complain basis	Monitoring Committee GSMB and PEA-NWP	Check whether the corrected noise levels are below to 55dB	Rs.50,000/- per year

## **HYDROGEOLOGICAL ASPECTS**

Monitoring will be done in three phases such as before mining, during the mining, and after the mining. Before monitoring will be started about three months before the mining operation and after monitoring will be continues for two years after the completing mining activities.

<b>Monitoring parameter and Method of monitoring.</b>	<b>Location</b>	<b>Parameters to be monitored</b>	<b>Frequency of monitoring</b>	<b>Institutional framework for mitigation of impact</b>	<b>Responsible agency/agencies of monitoring</b>	<b>Cost of monitoring</b>
Groundwater level.  <b>Method of monitoring-</b> in the field using water level indicators or piezometers. The monitoring bore holes (BH 1, BH 2, BH 3, BH 4) is proposed to construct in given locations.	Dug wells (DW 1, DW 3, DW 11, DW 12, DW 14), Deep bore holes (BH 1, BH 2, BH 3, BH 4).	Groundwater level	Monthly	Check the changers in groundwater level and compared with the water level in previous mined area and rainfall	WRB, PEA-NWP, NGO, PS, DS, ID, DAS, or self-monitoring.	Rs.80,000/- per year.
Flow rate and water level of Dehi Ela and	One places close to the mine in Dehi	Flow rate (cubicmeters per day) and water level	Monthly	Check the changers in flow rate and water	WRB, DS, PEA-NWP, NGO, PS, ID, DAS or self-	Rs.80,000/- per year

<p>Attanagalu Oya</p> <p><b>Method of monitoring-</b> in the field (flow measurement structure across the Dehi Ela and Attanagalu Oya is proposed to construct). Water level indicators should be used for measurement of water level</p>	<p>Ela and Attanagalu Oya</p>			<p>level and compared with the rain fall</p>	<p>monitoring.</p>	
<p>Water quality</p> <p><b>Method of monitoring-</b> in the field and lab using water quality measuring equipment.</p>	<p>Dug wells (DW1, DW 11) mine water, Monitoring wells (BH 1 and BH 2), Dehi Ela, Attanagalu</p>	<p>Physical and chemical parameters (pH, colour, turbidity, TDS, EC, hardness, calcium, nitrate, fluoride, nitrite, chloride, fluoride, iron,</p>	<p><b>Groundwater</b>-two times per year (dry and rainy period)</p> <p><b>Surface water.</b> -monthly</p>	<p>Check the changers in water quality and conditions of silt traps and storm water management system.</p>	<p>WRB, PEA-NWP, NGO, DS, PS, DAS or self-monitoring.</p>	<p>Rs.80,000/- per year</p>

	Oya.	sulphate, phosphate, and total alkalinity). Bacteriological parameters (total coli forms and E Coli)				
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Abbreviation- WRB-Water Resource Board  
 PS - Pradeshiya Sabha  
 Attanagalla

CEA- Central Environmental Authority  
 NGO-Non Government Organization

DAS- Department of Agrarian Service  
 DS-Divisional Secretary, Attanagalla

A rain gauging station is proposed to install at the site and water level measurements will be plotted simultaneously with the rainfall. In addition, the flow rate of the Dehi Ela and Attanagalu Oya is proposed to monitor monthly and structures for the flow measurement is proposed to construct before the mining.

Also, proposed monitoring bore holes (BH 1, BH 2, BH 3, BH 4) is needed to construct at given locations before starting the mining activities.

**GEOLOGICAL ASPECTS**

No	Monitoring parameter and Method of monitoring.	Proposed location of sampling point	Frequency of monitoring	Responsible agency/ agencies of monitoring	Institutional framework for mitigation of impact	Cost of monitoring
1.	Surface Runoff and Erosion	Soil erosion from downward hill slope	Every 2 weeks	Monitoring Committee PEA-NWP GSMB NBRO DS – Envi. Officer (Ridigama) PS - Ridigama	Check whether soil exposed sections on the downward hill slope are grass turfed	Rs.60,000/- per year
		Siltation in the Ela at the bottom of the hill slope	Monthly	Monitoring Committee PEA-NWP GSMB NBRO DS – Envi. Officer (Ridigama) PS - Ridigama	Check whether built up drains and silt traps are erected as proposed Check whether cleaning of silt traps are conducted frequently	Rs.60,000/- per year
2.	Surface Drainage System and 10 silt traps	Hill slope where the main shaft is located	During rainy periods	Monitoring Committee PEA-NWP GSMB DS – Envi. Officer (Ridigama) PS - Ridigama	Check whether the surface drainage system with a proper lining at the base and proposed 10 silt traps are properly erected	Rs.60,000/- per year

3.	Cut slopes & road cuts	Hill slope where the main shaft is located	Every 2 weeks	Monitoring Committee PEA-NWP GSMB NBRO DS – Envi. Officer (Ridigama) PS - Ridigama	Check whether cut slopes and road cuts are stabilized with the help of proper stabilization methods	Rs.60,000/- per year
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### **ECOLOGICAL ASPECTS**

<b>Parameters to be monitored</b>	<b>Frequency of monitoring</b>	<b>Location/ agency/agencies of monitoring</b>	<b>Responsible</b>	<b>Cost of Monitoring</b>
Replanting of surroundings/ access roads, level of natural regeneration in the restored areas	Once in three months	Replanting/ restoration areas after the mining operations are completed/ PEA-NWP	<b>Funds:</b> To be provided by the Client	Rs.60,000/- per year
Establishment of invasive alien species in the restored areas	Once in three months, especially after rainy season	CEA with assistance from Forest Department	<b>Funds:</b> To be provided by the Client	Rs.60,000/- per year

## **SOCIOLOGICAL ASPECTS**

No	Parameters to be monitored	Location /sampling points	Frequency of monitoring	Responsible agency/agency of monitoring	Facilities, funds availability	Institutional frame work *
01	Number of employments opportunities for villages	Site office	During the project implementation /operation	Project Proponent & Community Leaders	Project proponent	Village level coordination committee (VLCC)
02	Effects on houses /cultivations/ private property	Surrounding houses /home gardens/properties	During the project operation	Project Proponent, Village level officers & Community Leaders	Project proponent	DS/PS/SSD/GN /DO and VLCC
03	Effects on interior roads due to transportation	Nikahatiya – Karasnagala byroad	During the project operation	Project Proponent, Village level officers & Community Leaders	Project proponent	DS/PS/ASD/GN/DO and VLCC
04	Inappropriate behavior of migratory workers	Surrounding village Residences of migratory workers	Once a month /salary days	Project Proponent and Village level officers	Project proponent	GN/AP&TA and VLCC
05	Water stagnation points/Mosquito breeding points	Graphite mining site and surrounding area,	During the project operations, Daily	Project Proponent, Pradeshiya Sabha, PHI (Health Dept)	Project proponent	PHI & VLCC
07	Health impacts	Surrounding community and workers	Twice a year	Project proponent/MOH	Project proponent	VLCC& MOH, PHI
08	Construct a pipe water scheme and School to the village	Nikahatithanna and Amudhachchaheena Villages	During the project operation period	Project proponent	Project proponent	VLCC/Pradeshiya Sabha/
*VLCC= Village level Coordination committee, DS=Divisional Secretariat, PS=Pradeshiya Sabha, GN=Grama Niladhari, DO=Development Officer, MOH=Medical Officer of Health, PHI=Public Health Inspector, SSN=Samurdhi Sanwardana Niladhari						

## **CHAPTER - 7**

### **FINANCIAL COMMITMENTS**

## **CHAPTER - 8**

### **CONCLUSIONS AND RECOMMENDATIONS**

## **ANNEXES**

	<b>Page</b>
<b>ANNEX – I</b>	: Terms of Reference
<b>ANNEX – II</b>	: Sources of data & information
<b>ANNEX – III</b>	: References
<b>ANNEX – IV</b>	: List of prepares including their work allocation
<b>ANNEX – V</b>	: Comments made by public, NGO's and other agencies during the formal and informal scoping meetings held by the IEE team.
<b>ANNEX – VI</b>	: Complete set of relevant maps, tables, charts, lay out plans and other details
<b>ANNEX – 1.1</b>	: Copy of the Artisanal Mining License
<b>ANNEX – 1.1A</b>	: Copy of the Exploration License
<b>ANNEX – 1.4</b>	: Clearance from the Divisional Secretary of Ridigama for Implementation of the Project
<b>ANNEX – 1.4A</b>	: Clearance from Ridigama Pradeshiya Sabha
<b>ANNEX – 1.4B</b>	: Clearance from Department of Archaeology
<b>ANNEX – 1.4C</b>	: Clearance from Urban Development Authority
<b>ANNEX – 2.2.5</b>	: Copy of the Land Ownership Deed
<b>ANNEX – 2.4.6</b>	: Test Blast Report
<b>ANNEX – 2.4.8</b>	: Detailed Landslide Investigation Report
<b>ANNEX – 3.1.1.3.2:</b>	Chemical and Physical Water Quality Parameters of Groundwater (DW1) and Surface Water (Kirindi Oya)
<b>ANNEX – 3.2.2</b>	: Recorded Flora Species within the Project Area
<b>ANNEX – 3.2.2A:</b>	Recorded Fauna Species within the Project Area
<b>ANNEX – 3.2.2B:</b>	Some Ecologically Important Photographs within the Project Area
<b>ANNEX – 4.2.1.2:</b>	Pre-Crack Survey Report
<b>ANNEX – 4.2.2.3:</b>	Geohydrological Report Prepared by Water ResourcesBoard

**ANNEX – I**

**Terms of Reference**



## **ANNEX - II**

### **Sources of Data & Information**

## **Sources of Data & Information**

Data and information for preparing this report have been gathered from the following sources.

1. Available published and unpublished data at government institutions.
2. Field surveys conducted by the IEE study team.
3. Interviewing villagers, NGO's, and other local societies.
4. Discussions with relevant officials of local government institutions
5. Discussions with officers of RS Mines (Pvt.) Ltd.

Information generation for the study depended mainly on the quantitative and qualitative data sources such as field visits, household survey, interviews with key informants within the proposed project area. They were used to identify the existing human settlements, socio-economic and cultural backgrounds, land use pattern, existing environment including water sources and use pattern, cultivation, existing infrastructure facilities and development trends of the area etc. Also, secondary information sources such as the project related documents and maps, test reports, socio economic profile of Kotuhena Grama Niladhari Division (GND) and information from Grama Niladhari and village leaders of the area were used in report preparation.

## **ANNEX – III**

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### Geology

Geological Map of Dambulla – Pallegama on 1:100,000 scale (Sheet No. 11)

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Landslide Hazard Zonation Map of the Area Around Ridigama, published by the National Building Research Organization (NBRO)

### Ecology

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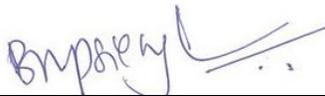
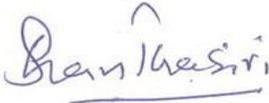
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## **ANNEX – IV**

### **List of Prepares**

**List of Consultants and their Work Allocation**

No.	Name	Qualifications	Area of Study	Signature
1.	Prof. P.G.R. Dharmaratna	BSc (Mining Engineering)  MSc  PhD	Mining Related Study	
1.	Dr. Ranjith Premasiri	B.Sc. Geology Sp. (Peradeniya)  M.Phil in Earth Resources Engineering (Uni. of Moratuwa)  PhD in Applied Geophysics (Keele University in United Kingdom)	Geology Related Study	
2.	Prof. B.M.P. Sinhakumara	BSc – Sri Jayawardenapura  D.Phil (Oxon)	Ecological Study	
3.	Mr. Mahinda Premathilake	B.Sc. Geology Sp. (Peradeniya)  M.Sc. Hydrogeology (Peradeniya)	Hydrological and Hydrogeological Study	
4.	Mr. Dulram Gunasekara	BSc Mining Engineering (Moratuwa)  MSc Environmental Science (Colombo)	Overall Report Compilation	
5.	Mr. H.K.S. Shanthasiri	BA Sociology Sp. (Peradeniya)  MA Sociology (Peradeniya)	Sociological Study	

## **ANNEX – V**

### **Comments Made by Public, NGO's and Other Agencies during the Formal and Informal Scoping Meetings Held by the IEE Team**



**ANNEX – VI**

**Complete Set of Relevant Maps, Tables, Charts,  
Lay Out Plans and Other Details**

## **Complete Set of Relevant Maps, Tables, Charts, Lay Out Plans and Other Details**

All the maps, tables, charts, lay out plans and other details are included in respective sections of the report for easy reference.

Other details are annexed.

**ANNEX – 1.1**

**Copy of the Artisanal Mining License**



**ANNEX – 1.1A**

**Copy of the Exploration License**



**GEOLOGICAL SURVEY AND  
MINES BUREAU  
(SRI LANKA)**

No:EL/341/R/1

**EXPLORATION LICENCE**

This Exploration Licence is hereby issued to **R.S. Mines (Pvt) Ltd.** of **Thalagahamulla Henyaya, Ratamiriskotuwehena, Maduragoda** in the **Central** Province of Sri Lanka to exercise the exclusive right to explore for **Graphite** within that area falling within the **North Western** Province of Sri Lanka, and comprising of **01 (one)** square kilometre grid units designated by the following metric grid co-ordinates as identified by the holder in accordance with regulation 4 (4) of Mining (Licensing) Regulations, No.1 of 1993.

**METRIC GRID UNIT NUMBER:**

174265

Falling within the Official Licensing Control System Map No. **48**

The exploration licence area demarcated map is attached (Attachment 3)

This Exploration Licence is issued subject to the rights of the owner or occupant of the land covered by this licence and to the provisions of the Mines and Minerals Act, No.33 of 1992 and Regulations made thereunder and of any Act or Regulations in amendment thereof, and such other terms and conditions set out in Attachment 1 & 2 marked hereto and over leaf.

This licence shall be valid for a period of 24 months beginning from **2020.07.30** until **2022.07.29**

This licence is duly executed in the name of the Director General of Geological Survey and Mines Bureau this 29<sup>th</sup> July 2020 at No. 569, Epitamulla Road, Pitakotte.

Witness *29/7/20*

*U de sir*  
.....  
for **Director General**  
**GEOLOGICAL SURVEY & MINES BUREAU**

*K.T.U.S. 29/07/2020*  
Senior Director - Geology  
Geological Survey and Mines Bureau  
No. 569  
Epitamulla Road,  
Pitakotte

Page 1 of 4

## **ANNEXES –1.4 – 1.4C**

**ANNEX –1.4** : Clearance from the Divisional Secretary of Ridigama for Implementation of the Project

**ANNEX – 1.4A** : Clearance from Ridigama Pradeshiya Sabha

**ANNEX – 1.4B** : Clearance from Department of Archaeology

**ANNEX – 1.4C** : Clearance from Urban Development Authority

<p>දුරකථන අංකය Telephone Nos: 2694727</p> <p>2694727</p> <p>පුරාවිද්‍යා දෙපාර්තමේන්තුව Archaeological Department</p> <p>www.archaeology.gov.lk</p> <p>2696250 2682470</p>	 <p><b>පුරාවිද්‍යා දෙපාර්තමේන්තුව</b> Archaeological Department</p> <p>ශ්‍රී ලංකා ප්‍රජාතාන්ත්‍රික සමාජවාදී ජනරජය Government of the Democratic Socialist Republic of Sri Lanka</p>	<p>මගේ අංකය - ARCH/NW/03/EXP/KU/03/RDG/2020</p> <p>ඔබේ අංකය - IML/A/N/2019/1300</p> <p>පළාත් පුරාවිද්‍යා කාර්යාලය (වයඹ), පැරණි මාලිගා පරිශ්‍රය, කුරුණෑගල</p> <p>037-2220475</p> <p>2020 ජූලි මස 9 දින</p>														
<p>බලයලක් නිලධාරී, භූ විද්‍යා සමීක්ෂණ හා පතල් කාර්යාංශය, එපිට්ලිල්ල පාර, පිටකෝටුවේ.</p> <p><b>බනිජ හා පාෂාණ නිස්සාරණ සඳහා පුරාවිද්‍යා නිර්දේශ ලබාගැනීම</b></p> <p>උක්ක මැයෙන් මා ඇමතු ඔබේ සමාංක හා 2020/06/29 දිනැති ලිපිය හා මගේ සමාංක සහ 2020/06/01 දිනැති ලිපියට වැඩිමනත් වශයෙනි.</p> <p>එම ලිපියෙන් විචේකෝන් නිවස, මාදිපොල, මාතලේ ලිපිනයැති ආර්.එස්.මයිස් පුද්ගලික සමාගමේ අයදුම්පත සමග ඉදිරිපත්කල ඔබගේ ඉල්ලීම් ලිපියේ සඳහන්කර තිබූ ආකාරයට අංක 5652 හි කැබලි අංක 01 මගින් දැක්වෙන තලගහමුලහේන්යාය නැමැති ඉඩමේ පර්චස් 28.0ක් සඳහා පුරාවිද්‍යා නිර්දේශය ලබාදී ඇත.</p> <p>එහෙත් ඉල්ලුම්කරු විසින් 2020/06/29 දිනැති ඉල්ලීම් ලිපිය මගින් පිඹුරුපත් අංක 5652 හි කැබලි අංක 02 සඳහා පුරාවිද්‍යා නිර්දේශ ඉල්ලා ඇත.</p> <p>ඒ අනුව අක්කර 08 රුධ 01 පර්චස් 38.0 ක්වූ එම භූමි ප්‍රදේශය මතුපිට හා තදාශ්‍රිතව පුරාසාධක දක්නට නොමැති බැවින්</p> <table border="0" style="width: 100%;"> <tr> <td>උතුරින්</td> <td>:-</td> <td>අ.ග.8 2470 හි T.P.5844 හි Lot No 1<sup>AB</sup></td> </tr> <tr> <td>නැගෙනහිරින්</td> <td>:-</td> <td>අ.ග.8 2470 හි Lot No 1, Lot No 60</td> </tr> <tr> <td>දකුණින්</td> <td>:-</td> <td>අ.ග.8 1144 උඩත්තාපොල ගම්මායීට</td> </tr> <tr> <td>බටහිරින්</td> <td>:-</td> <td>අ.ග.8 1145 මීපිටිය</td> </tr> </table> <p>මායිමගත කොටසේ මිනිරන් කැණීම සඳහා පුරාවිද්‍යා නිර්දේශය ලබාදෙන අතර මගේ සමාංක හා 2020/06/01 දිනැති ලිපියෙහි අනෙකුත් කොන්දේසි එලෙසින්ම බලපැවැත්වෙන බවද කාරුණිකව දන්වා සිටිමි.</p> <p style="text-align: center;"><b>එල්.එම්.ඉණතිලක බණ්ඩා</b> පුරාවිද්‍යා සහකාර අධ්‍යක්ෂ (වයඹ) වයඹ පළාත් පුරාවිද්‍යා කාර්යාලය පැරණි මාලිගා පරිශ්‍රය - කුරුණෑගල</p> <p>පිටපත්:-</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 60%;"> <ol style="list-style-type: none"> <li>1. සහකාර අධ්‍යක්ෂ (නිශ්චල දේපල)</li> <li>2. ප්‍රාදේශීය ලේකම්, ප්‍රාදේශීය ලේකම් කාර්යාලය, පිදිගම.</li> <li>3. ආර්.එස්.මයිස් පුද්ගලික සමාගම, විචේකෝන් නිවස, මාදිපොල, මාතලේ</li> <li>4. කලාප භාර නිලධාරී, කලාප අංක 05</li> </ol> </td> <td style="width: 40%; vertical-align: top;"> <ul style="list-style-type: none"> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> </ul> </td> </tr> </table>			උතුරින්	:-	අ.ග.8 2470 හි T.P.5844 හි Lot No 1 <sup>AB</sup>	නැගෙනහිරින්	:-	අ.ග.8 2470 හි Lot No 1, Lot No 60	දකුණින්	:-	අ.ග.8 1144 උඩත්තාපොල ගම්මායීට	බටහිරින්	:-	අ.ග.8 1145 මීපිටිය	<ol style="list-style-type: none"> <li>1. සහකාර අධ්‍යක්ෂ (නිශ්චල දේපල)</li> <li>2. ප්‍රාදේශීය ලේකම්, ප්‍රාදේශීය ලේකම් කාර්යාලය, පිදිගම.</li> <li>3. ආර්.එස්.මයිස් පුද්ගලික සමාගම, විචේකෝන් නිවස, මාදිපොල, මාතලේ</li> <li>4. කලාප භාර නිලධාරී, කලාප අංක 05</li> </ol>	<ul style="list-style-type: none"> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> </ul>
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දකුණින්	:-	අ.ග.8 1144 උඩත්තාපොල ගම්මායීට														
බටහිරින්	:-	අ.ග.8 1145 මීපිටිය														
<ol style="list-style-type: none"> <li>1. සහකාර අධ්‍යක්ෂ (නිශ්චල දේපල)</li> <li>2. ප්‍රාදේශීය ලේකම්, ප්‍රාදේශීය ලේකම් කාර්යාලය, පිදිගම.</li> <li>3. ආර්.එස්.මයිස් පුද්ගලික සමාගම, විචේකෝන් නිවස, මාදිපොල, මාතලේ</li> <li>4. කලාප භාර නිලධාරී, කලාප අංක 05</li> </ol>	<ul style="list-style-type: none"> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> <li>- දැනගැනීම සඳහා</li> </ul>															

දුරකථන අංකය 2694727  
 දුරකථන අංකය 2694727  
 විද්‍යුත් තැපෑල www.archaeology.gov.lk  
 ෆැක්ස් 2694730



**පුරාවිද්‍යා දෙපාර්තමේන්තුව**  
**ARCHAEOLOGICAL DEPARTMENT**

ශ්‍රී ලංකා දමතරක්‍රීය සමාජවාදී ජනරජය  
 Government of the Democratic Socialist Republic of Sri Lanka

මගේ අංකය - ARCH/NW/03/EXP/KU/03  
 /2/RDG/2020

මිනිසුන් අංකය -  
 පළාත් පුරාවිද්‍යා කාර්යාල (පැරණි),  
 පැරණි මාලිගා පරිශ්‍රය,  
 කුරුණෑගල  
 037-2220475

දිනය :- 2020 ජූනි මස 10 දින

ලේඛකාරීකාරී,  
 භූවිද්‍යා සමීක්ෂණ හා පතල් කාර්යාලය,  
 අංක 569, එපිටමුල්ල පාර,  
 පිටකෝට්ටේ.

**බනිප් හා පාෂාණ නිස්සාරණ සඳහා නිර්දේශ ලබාදීම**

ඉහත කරුණ සම්බන්ධයෙන් මා අමතන ලද මඟේ අංක IML/A/N/2019/1300 හා 2019/12/05 දිනැති ලිපිය හා බැඳේ.

02. ඒ අනුව විචේකෝන් නිවස, මාදිපොල, මාතලේ ලිපිනය සඳහන් වන ආර.එස්.මයිස් පුද්ගලික සමාගම විසින් වයඹ පළාතේ කුරුණෑගල දිස්ත්‍රික්කයේ පිදිගල ප්‍රාදේශීය ලේකම් කොට්ඨාසයේ අංක 539 කොටුගේනා ග්‍රාම නිලධාරී වසමේ කොටුගේනා ග්‍රාමයේ විකුණුම්කර අංක 159 සහ පිඤ්ඤාපත් අංක 5652 යටතේ දැක්වෙන තලගහමුල්ලහේන්යාය නැමැති ඉඩමේ බිම් කට්ටි අංක 01 දරණ

උතුරින්	-	LOT NO 1AB IN FVP 2470
නැගෙනහිර	-	LOT NO 1AB IN FVP 2470
දකුණින්	-	LOT NO 1AB IN FVP 2470
බටහිරින්	-	මීටිය FVP 1145

මධ්‍යාගමව පිහිටි පර්වස් 28.0 ක බිම් කොටසේ මිනිරන් කැණීම සඳහා ආර.එස්.මයිස් පුද්ගලික සමාගම විසින් අවසර ඉල්ලා ඇති ස්ථානයේ මාගේ නිලධාරීන් විසින් පරීක්ෂා කර මායිම් ලකුණු කර පෙන්වා දී ඇති භූමිය හා තදාසන්න කලාපයේ පුරාවිද්‍යා ස්මාරක හෝ පුරාතනි හෝ අනික මානව ක්‍රියාකාරකම් පිළිබඳව සාධක මතුපිට නොමැති බව වාර්තා කර ඇත. එම වාර්තාවට අනුව සහ පහත සඳහන් කොන්දේසිවලට යටත්ව වාර්ෂික 2020 / 06 / ..... දින සිට 2021 / 06 / ..... දින දක්වා අදාළ කාර්යය සිදු කිරීමට නිර්දේශ ලබාදෙන බව කාරුණිකව දන්වමි.

මෙම නිර්දේශයෙන් අවසර ලබා දී ඇති භූමි පිටාව තුළ පමණක් අදාළ ව්‍යාපෘතිය පවත්වාගෙන යා යුතුය. එකී සීමාවෙන් පිටත කිසිදු අනවසර ක්‍රියාවක් සිදු නොකළ යුතුය.

- I. මෙම නිර්දේශයෙන් අවසර ලබාදී ඇති ස්ථානය මිනිරන් කැණීමේදී / බනිප් නිස්සාරණයේදී හෝ ස්ථානයේ භූමිය ඉදිකිරීමේදී හෝ වෙන යම් අවස්ථාවකදී පුරාවස්තුවක් හෝ ඒ යැයි සැක කළ හැකි යමක් හමුවූ විගස වහාම එම කාර්යය නවතා ඒ බව පුරාවිද්‍යා අධ්‍යක්ෂ ජනරාල් හෝ පළාතේ පුරාවිද්‍යා සහකාර අධ්‍යක්ෂවරයාට දැන්විය යුතුය. (ද.ක. 037-2220475)
- II. අදාළ නිර්දේශ ලබාදීමෙන් පසු පුරාවිද්‍යා දෙපාර්තමේන්තු නිලධාරීන් නැවත ස්ථානය පරීක්ෂා කිරීමෙන් අනතුරුව පුරාවිද්‍යාත්මක වටිනාකමක් අනාවරණය කරගතහොත් තවදුරටත් එම මිනිරන් හෝ බනිප් නිස්සාරණ ස්ථානය පවත්වාගෙන යාමේ නිර්දේශය පුරාවිද්‍යා අධ්‍යක්ෂ ජනරාල්ට කොන්දේසි වර්ගීකරණ අවලංගු කළ හැකිය.
- III. ඉහත කොන්දේසිවලට අනුව කටයුතු නොකළහොත් පුරාවිද්‍යා පාඤා පනතේ විධිවිධානයන්ට යටත්ව අදාළ පුද්ගලයාට වරදකට නීතිමය පියවර ගනු ලැබේ.
- IV. මෙම දෙපාර්තමේන්තුවේ බලයලත් ඕනෑම නිලධාරියකුට අවශ්‍ය ඕනෑම අවස්ථාවක කිසිදු බාධාවකින් තොරව අදාළ භූමිය පරීක්ෂා කිරීම සඳහා සාධාරණ පහසුකම් සැලසිය යුතුය.
- V. කුමන හේතුවක් මත හෝ මෙම නිර්දේශය පුරාවිද්‍යා අධ්‍යක්ෂ ජනරාල් විසින් අවලංගු හෝ අත්හිටුවන ලැබුවහොත් එමගින් සිදුවන සියලු අලාභයන් හෝ පාඩු පිළිබඳව මෙම දෙපාර්තමේන්තුව හෝ දෙපාර්තමේන්තු නිලධාරියකු විසින් වගකීමක් දරණු නොලබන බව සිදුකළ හැකිවන්නේ මතුපිටට දර්ශනය වන පාෂාණ උද්ගතයන්හි පමණක් බවත් කිසිසේත් පොළොව අභ්‍යන්තරයන්ට පාෂාණ කැණීම් හා බිදුම් සිදුනොකළ යුතුය.
- VII. මෙම නිර්දේශය අදාළ ව්‍යාපෘතිය හැර වෙනත් ව්‍යාපෘතීන් සඳහා භාවිතා නොකළ යුතුය.

ප්‍රාදේශීය සහකාර අධ්‍යක්ෂ (වයඹ)

**එල්.එම්.ඉණතිලක බණ්ඩා**  
**පුරාවිද්‍යා සහකාර අධ්‍යක්ෂ**  
**වයඹ පළාත් පුරාවිද්‍යා කාර්යාලය**  
**පැරණි මාලිගා පරිශ්‍රය - කුරුණෑගල**

අ/කලේ:- පුරාවිද්‍යා අධ්‍යක්ෂ ජනරාල්

පිටපත්:-

- |  |   |               |
|--|---|---------------|
| 1. සහකාර අධ්‍යක්ෂ (නිශ්චල දේපල)                                | - | දැනගැනීම සඳහා |
| 2. ප්‍රාදේශීය ලේකම්, ප්‍රාදේශීය ලේකම් කාර්යාලය, ඉබ්බාතොටුව.    | - | දැනගැනීම සඳහා |
| 3. ආර.එස්.මයිස් පුද්ගලික සමාගම, විචේකෝන් නිවස, මාදිපොල, මාතලේ. | - | දැනගැනීම සඳහා |
| 4. කලාප හා නිලධාරී, කලාප අංක 05                                | - | දැනගැනීම සඳහා |

නාගරික සංවර්ධන, ජල සම්පාදන සහ නිවාස පහසුකම් අමාත්‍යාංශය  
நகர அபிவிருத்தி, நீர்வழங்கல் மற்றும் வீடமைப்பு வசதிகள் அமைச்சு  
MINISTRY OF URBAN DEVELOPMENT, WATER SUPPLY AND HOUSING FACILITIES

දුරකථන  
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Telephone } 2875916-20 2873651-2  
2873644 2873647  
2873649 2875333  
2797200



නාගරික සංවර්ධන අධිකාරිය  
நகர அபிவிருத்தி அதிகாரசபை  
Urban Development Authority

6,7 සහ 9 වන මහල, සෙත්තිරිපාය, මත්තමුල්ල  
6,7 மற்றும் 9ஆம் மாடிகள் செத்திநிபாய,பத்தரமுல்லை  
6,7 & 9 Floors sethsiripaya, Battaramulla

වෙබ් අඩවිය  
இணையத்தளம்  
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Deputy Director (Planning) 037 - 2220908 //Deputy Director (Project) 037 - 2230133 /Deputy Director (Legal) 037 - 2224165

මගේ අංකය :- 26/01/03/PPC/48/2020  
නාගරික සංවර්ධන අධිකාරිය,  
වයඹ පළාත් කාර්යාලය,  
310ඩී, මීගමුව පාර,  
කුරුමෑගල.  
2020 මැයි මස 12 වන දින.

කැණීම් ඉංජිනේරු,  
භූ විද්‍යා සමීක්ෂණ හා පතල් කාර්යාංශය,  
ප්‍රාදේශීය කාර්යාලය,  
නො: 72, විල්ගොඩ පාර,  
කුරුමෑගල.

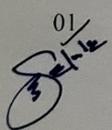
1992 අංක 33 දරණ පනත හා එකී පනත සංශෝධනය කරමින් නිකුත් කරන ලද 2009 අංක :66 දරණ සංශෝධිත පනත යටතේ නාගරික සංවර්ධන අධිකාරි කලාපය තුළ බණ්ඩ කැණීම් (නිතිරම්) සඳහා බලපත්‍ර නිකුත් කිරීම.  
අයදුම්පත් අංක : IML/A/N/2019/1300 රට මිරිස් කොටුවේ හේන, කොටුවේන, රිදීගම.

උක්ත කරුණ සම්බන්ධයෙන් ඔබේ අංක හා 2019.12.05 දිනැති ලිපිය හා බැඳේ.

02. ඒ අනුව උක්ත ~~නොරම්~~ කැණීම සඳහා ඉල්ලුම් කර, ඉඩම නාගරික සංවර්ධන අධිකාරියේ ප්‍රකාශිත බල ප්‍රදේශයට අයත් නොවන බැවින්, යෝජිත සංවර්ධනය සඳහා මෙම අධිකාරියේ නිර්දේශය අත්‍යාවශ්‍ය නොවන බව කාරුණිකව දන්වා සිටිමි.

ඊ.එම්.එස්.බී. ඒකනායක  
අධ්‍යක්ෂ (වයඹ පළාත)

පිටපත:-

01/  එස්.ඒ. විජේකෝන් මයා  
"විජේකෝන් හවුස්", මාදිපොල පාර,  
මාතලේ.

- කා. දැ. ගැ ස

**ANNEX – 2.2.5**

**Copy of the Land Ownership Deed**

වසන්ත ආර්යරත්න  
නීතිඥ සහ ප්‍රසිද්ධ තොකාරිස්  
යාපාගම, දඹුල්ල



08



පෙර ලියාපදිංචිය : L 13 / 31 , 32

ඉඩම 02 ය.

අංකය :- 159

විකුණුම්කරය රු.900,000 /=

සියලු දෙනාම මෙයින් දැනගත යුතුයි.

L/13/31,32  
2014-11-11

මෙහි පහත ඇතැම් තැනැත්තන් විකුණුම්කර පක්ෂය යැයි කියනු ලබන, 2014-11-11

වයඹ පළාතේ, කුරුණෑගල දිස්ත්‍රික්කයේ රජමල් උයන, කොළඹ පාර, කුරුණෑගල නැමැති ලිපිනයේ පදිංචි විකුණුම්කර කීර්ති කුලරත්න විරක්කොඩිගේ වන මා හට මාතලේ ප්‍රසිද්ධ තොකාරිස් ගැන වන වසන්ත ආර්යරත්න මහතා විසින් ලියා සහතික කරන ලද අංක 117 යන 2014 වූ මාර්තු මස 24 වන දින දරණ විකුණුම්කර ස්ඵූර්ණ පිට අයිතිවාසිකම් පිසින නිරවුල් ලෙස හුණි විදිනු ලබන මෙහි පහත උපලේඛන ගත දේපළ :

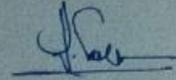
ඊට අදාළ එහි කොටසක් හැටියට ඒ සමග හුණි විදින වෙනත් සියලුම දේ ද ඒ ගැන විකුණුම්කර මට ඇතිව තිබෙන මුල් හිමිකම්, අයිතිවාසිකම්, උරුමකම්, වැදගත්කම් ද බලපූර්වත්කම් ද ඇතුළුව ශ්‍රී ලංකාවේ වලංගු වන මුදලෙන් රුපියල් ලක්ෂ නවයකට (රු. 900,000/=) මෙහි පහත ඇතැම් තැනැත්තන් ගැන විකුණුම්කර පක්ෂය යැයි කියනු ලබන විමර්ශන නිවස මාදිපොල ලිපිනයෙහි ප්‍රධාන කාර්යාලය පිහිටා ඇති ආර්. එස්. මයිනිස් සුද්ධලික සමාගමට (2007 අංක 07 දරණ සමාගම් පනත යටතේ ලියාපදිංචි වූ ලියාපදිංචි අංකය : 63323) සහ එහි උරුමකර, පොල්මාකාර, අදමනිස්ත්‍රායිකාර, ලැබුම්කාරාදීන්ගේ මෙයින් සින්නක්කරයේ විකුණා පයිතිකර හිමිකම් පවරා භාර දී එහි මුදල සම්පූර්ණයෙන් ගැන භාර ගනිමි.

තව ද මෙයින් අයිතිකරුවන් ඉහත කී දේපළ ගැන මට ඇත්ත වූ සියලු අයිතිවාසිකම් හිමිකම් හා බලපූර්වත්කම් සමග ඉහත කී ගැනුම්කර ආර්. එස්. මයිනිස් සුද්ධලික සමාගමට එහි උරුමකාරාදීන්ගේ මෙවන් පවත් සම්පූර්ණයෙන් අයිතිව අද පවත් සඳහා භුක්ති විදීමට හෝ වෙන ඕනෑම කැමැත්තක් කර ගැනීමට පුලුවන් වූ බලය හා නිදහසක් මෙයින් පවරා දනිමි.

R.S. මයිනිස් (ඉ) පක්ෂය  
විමර්ශන නිවස  
මාදිපොල - මාතලේ

  
Kumudanti





තව ද මෙයින් අයිතිකර දුන් ඉහත කී දේපළ එසේ අයිතිකර දීමට නිසි ප්‍රකාර නිසි අයිතිකම් හා බලය විකුණුම්කාර මව ඇති බව ද එකී දේපළ හෝ එහි යම් කොටසක්වත් එහි එල ප්‍රයෝජනාදියක්වත් මින් පෙර දැනට වලංගු පවතින මොනම උගසකට බද්ධකට බැඳීමකට හෝ තහනමකට ඉහත කී විකුණුම්කාර මා විසින් යටත් කර නැති වග සහ මෙම දේපළ යටත් වන්නා වූ එක්කෝ මෙම දේපළ අස්ථිරවන්නා වූ මොනම ක්‍රියාවකට බැඳී නැති බවත් මෙයින් හෙළිදරව් කරමින් මෙම විකිණීම සැම අන්දමින් ම සවිකර දෙනු හැටියට ද මීට විරුද්ධව යම් කිසි විෂයක් පැමිණියහොත් එහි දී වගදැරීමට නියමිතව කටයුතු කර දෙන හැටියට ද එසේ නොදැනුවත් වී නම් වන්දි ගෙවන හැටියට ද මින් සපු එකී දේපළ සම්බන්ධව මීට අදාළ වූ මෙය වඩා ස්ථිරවීමට හේතු වූ යම් කිසි ඔප්පු නිරපේක්ෂ ආදිය සාදවා දෙන හැටියට ඉහත කී ගැණුම්කරු විසින් හෝ එහි උරුමකාරයාදීන් විසින් කරුණු සහිතව එබඳු ඔප්පු නිරපේක්ෂ ආදියත් එසේ ඉල්ලා සිටින අයගේ වියදමින් සාදවා දෙන හැටියටත් ඉහත කී විකුණුම්කාර මා වෙනුවට සහ උරුමකාර, පොල්මකාර, අද්මිනිස්ත්‍රායිතාරාදීන් වෙනුවට ඉහත කී ගැණුම්කාර සහ ඔහුගේ ඉහත කී උරුමකාරයාදීන් සමග මෙයින් පොරොන්දුව බැඳෙනමි.

**ඉහත කී උපලේඛනය**

01. වයඹ පළාතේ, කුරුණෑගල දිස්ත්‍රික්කයේ, හිරියාල හත්පන්තුවේ, රිදීගම ප්‍රාදේශීය ලේකම් කොට්ඨාශයේ, විදිගම ප්‍රාදේශීය සහ බල ප්‍රදේශයේ, කොටුහේන ග්‍රාම නිලධාරී කොට්ඨාශයේ ඉහල විසිදෙනේ නැගෙනහිර කෝරළයේ මදුරාගොඩ මිහිටි කන්දේ භිවබත කියා ඇතත් මදුරාගොඩ කොටු හේනේ නිවෙත කලගහවුල හේන් යායේ "රට මිහිස් කොටුවේ හේන" නැමති කුරහන් අටලාහක පමණ වපසරිය ඇති උකුරට -; ඇල හා කෙළඹ ගහ ද , නැගෙනහිරට -; අමර මලන්දාගේ හේනේ ඉඩම ද, දකුණට -; එම අගගේ දළක් ගලේ හේනේ ඇළ ද, බස්නාහිරට -; මුදුන්පිට ඇති පාර ද, යන මායිම් කුළ පිහිටි ඉඩම, එනම් 1917 ලංකා මැනුම් අනුව අ.ග.පි. 2470 හි ලොට් 58 හා 59 නම් වූ,

- උකුරට නැගෙනහිරට -; පි. 5844 හි සඳහන් ඉඩම ද,
  - දකුණට -; පි. 15044 හි සඳහන් ඉඩම ද,
  - බස්නාහිරට -; උඩන්නා පොළ සහ මිපිටිය ගම් මායිම් සහ පාර ද,
  - යන මායිම් කුළ පිහිටි අක්කර හතරකි, රූඩ් එකකි, පර්චස් කිස්හතරක් (අක් 04 රූඩ් 01 පර්.34 ) විශාල ඉඩම ද,
- (විකුණන ඉඩම)

සහ

02. එකී අ.ග.පි. 2470 හි ලොට් 57 නම් වූ

- උකුරට -; ලොට් 01 ද,
- කුණු නැගෙනහිරට -; පි. 5844 හි සඳහන් ඉඩම ද,
- බස්නාහිරට -; මිපිටිය ගම් මායිමට යන පාර ද,
- යන මායිම් කුළ පිහිටි පර්චස් විසි අටක් ( අක් 00 රූඩ් 00 පර් 28 ) විශාල ඉඩම ද වේ.

(විකුණන ඉඩම)



මානව දිගුකාලීනව සහතිකය, සුදුසු ලිපිනයේ පදිංචි වසන්ත ආර්යයන්ගේ ප්‍රසිද්ධ නොමැතිව පැන  
වන මා විසින් දෙනවා.

අප්‍රාදිලි ලෙස පිළිවෙලින් ඉංග්‍රීසියෙන් අත්සන් කළ රෝහල පාර, මාදිසොල නැමැති ලිපිනයේ  
පදිංචි ආර්යය වැලිගමගේ දුෂන්ත කුමාර ආර්යයන්ගේ සහ රෝහල පාර, මාදිසොල නැමැති ලිපිනයේ  
පදිංචි කුසුලු කුමාරි ආර්යයන්ගේ

සහ සාක්ෂිකාරකයන් ඉදිරිපිට දී එකී සාක්ෂිකාරකයන් විසින් හා මා විසින් සකසනු ලබන.

අප්‍රාදිලි ලෙස ඉංග්‍රීසියෙන් අත්සන් කළ නීර්ණි කුලරත්න විරක්කොඩිගේ නැමැති අයට.

එකී නොමැතිව පැන වන මා විසින් කියවා තේරුම් කර දුන් පසු කුණා විසින් ද ඉහත නී සාක්ෂිකාරකයන්  
විසින් ද මා විසින් ද සියලු දෙනාම එකට එක්ව පිටපත දී මා ඉදිරිපිට දී සහ සැලකෙන්න එකී නොමැති  
ඉදිරිපිට දී වර්ෂ 2014 ජූනි මාසයේ 10 වන දින මාගේ දුරකථන අංකයේ දී මෙහි අත්සන් කළ පළ  
මෙයින් සැබෑ කොට සහතික කරමි.

එම ද ඉහත පෙහෙත සේසුවේ සඳහන් මුදල මා ඉදිරිපිට දී ගනුදෙනු කොටු බවත්.

සහ මෙහි දෙවන පිටපතට රුපියල් කිහිපයක් දහසක් (රු.35,000/-) ක් වටිනා මහජන බැංකුවේ *Signature*  
සාක්ෂිකාරකයන් ලද මාක : PBS / NWP / A 107830 සහ වර්ෂ 2014 ජූනි මාසයේ 10 වන දින  
දින දරණ පිටපතක් මෙහි අලවා ඇති බවත් සහ මුල් පිටපතට රුපියලක් වටිනා මුද්දරයක් අලවා ඇති  
බවත් මෙයින් සැබෑ කොට සහතික කරමි.

සහතික කළේ වර්ෂ 2014 ජූනි මාසයේ 10 වන දින දී ය.



*[Handwritten Signature]*  
වසන්ත ආර්යයන්ගේ  
ප්‍රසිද්ධ නොමැතිව

පහත අවධානය

නීතිඥ හා ප්‍රසිද්ධ නොකාරීන්

යාචනා, දඹුල්ල

08



පෙර ලියාපදිංචි: L. 27 / 74

අංක 01 සී.

අංකය :- 160



විකුණුම්කරය රු. 700,000/=

L 27 / 74

Handwritten signature or initials.

සියලු දෙනාම මෙයින් දැනගත යුතුයි.

14.11.11

මෙහි පහත ඇතැම් තැනැත්තන් විකුණුම්කර පත්කළ යැයි කියනු ලබන,

ඔබාම පළාතේ, මාතලේ දිස්ත්‍රික්කයේ මාදිපොල, මහලාගුරු නැවතී ලිපිනයේ පදිංචි පහල  
තෙරුරු සමස්ත ( විසඳුම් බලපත්‍ර අංකය ඩී / එල් කේ ආ5 008304 ) වන මා හට මාතලේ ප්‍රසිද්ධ  
නොකාරීන් කැන වන ඩී.එම්.එල්.සී. දිසානායක මහත්මිය විසින් ලියා සහතික කරන ලද අංක 267 සහ  
2014 ක් පු මාර්තු මස 24 වන දින දරණ විකුණුම්කර මුද්‍රණ 80 අයිතිව මා විසින් නිරවුල් ලෙස තුනේ  
විදිනු ලබන මෙහි සහතික කරනු ලබන දේපල :

එම දෙපල එහි කොටසක් හැටියට එ සහතික කරනු ලබන මෙහි සියලුම දේ ද එ ගැන විකුණුම්කර  
මට ඇතිව තිබෙන පුලු හිමිකම්, අයිතිවාසිකම්, උරුමකම්, වැදගත්කම් ද බලපූරුවත්කම් ද ඇතුළුව ශ්‍රී  
ලංකාවේ වලංගු වන පුද්ගලයන් රුපියල් ලක්ෂ හතකට (රු. 700,000/=) මෙහි පහත ඇතැම් තැනැත්තන්  
තැනුම්කර පත්කළ යැයි කියනු ලබන විටෙකටත් නිවස, මාදිපොල ලිපිනයෙහි ප්‍රධාන කාර්යාලය  
පිහිටා ඇති ආර්. එස්. මයිනිස් සුද්ධලික සමාගමට (2007 අංක 07 දරණ සමාගම් පනත යටතේ  
ලියාපදිංචි වූ ලියාපදිංචි අංකය : 63323) සහ එහි උරුමකරු, පොල්මාකාර, අද්මිනිස්ත්‍රායිකාර,  
ලැබුම්කාරාදීන්ටත් මෙයින් සිත්තක්කරයේ විකුණා අයිතිකර හිමිකම් පවරා භාර දී එකී පුද්ගල  
සම්පූර්ණයෙන් ගැන භාර ගනිමි.

කව ද මෙයින් අයිතිකරුන් ඉහත කී දේපල ගැන මට ඇත්ත වූ සියලු අයිතිවාසිකම් හිමිකම්  
හා බලපූරුවත්කම් සම්බන්ධ කරන කී අයටත්, ඔහුගේ ඉහත කී උරුමකාරාදීන්ටත් පවතින පටන  
සම්පූර්ණයෙන් අයිතිව අද පටන් සදාකල් තුනේ විදීමට හෝ වෙන ඕනෑම කුමක්කක් කර ගැනීමටත්  
සුදුසු බලය හා නීත්‍රානුකූලව මෙයින් පවරා දුනිමි.

R. S. මයිනිස් ( ඉ ) සමාගම  
විදේශීයත්ව නිලධාරී  
මාදිපොල - මාතලේ

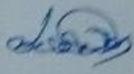


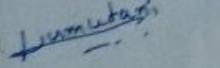
රට පාක්ෂි පිණිස ඉහත කී විධිවිධ කළ පහළ පහසු ජනවාර්ගික තැනැත්තන්

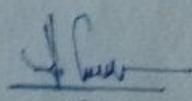
08 වන 2014 ක් පු පනවාලීමට මහ 10 වෙනි වන මහලේ කුමාරේ දී මිටි මහල පනවන බව දැනට දරණ පනත් ලියවිලි පදනමක් ඇත්තේ නැත.

**සාක්ෂි**

මීට පාක්ෂිකාරකයින් වන අප මෙහි අත්සන් කළ අප පනවාලීමට අදාළ බව ද, මිදුන්ගේ පමුණුක නම් රත්නවල් සහ මදි-වී ජාතික පනවන බව ද මෙයින් සහතික කොට ප්‍රකාශ කරමි.



- 01. 
- 02. 



පහත අධිකාරියේ  
ප්‍රධාන නිලධාරියා.

මාතලේ දිස්ත්‍රික්කයේ යාපාහම , දඹුල්ල ලිපිනයේ පදිංචි වසන්ත ආරියරත්න ප්‍රසිද්ධ නොතාරිස් කැන  
වන මා විසින් අදහන,

අපැහැදිලි ලෙස පිළිවෙලින් ආශ්‍රිතයෙන් අත්සන් කළ රෝහල පාර , මාදිපොල නැමැති ලිපිනයේ  
පදිංචි මාර්දිය වැලිගමගේ දුෂන්ත කුමාර ආරියරත්න සහ රෝහල පාර , මාදිපොල නැමැති ලිපිනයේ  
පදිංචි කුමුදුනී කුමාරි ආරියරත්න

සහ සාක්ෂිකාරයින් ඉදිරිපිට දී එකී සාක්ෂිකාරයින් විසින් හා මා විසින් හඳුනානු ලබන,

අපැහැදිලි ලෙස සිංහලෙන් අත්සන් කළ සහල ගෙදර ජයවර්ධන නැමැති අයට ,

එකී නොතාරිස් කැන වන මා විසින් කියවා තේරුම් කර දුන් පසු ඔහු විසින් ද ඉහත නී සාක්ෂිකාරයින්  
විසින් ද මා විසින් ද සියලු දෙනාම එකවිට එක්ව සිටිය දී මා ඉදිරිපිට දී සහ ඔවුනොවුන් එකී නොතා  
ඉදිරිපිට දී වර්ෂ 2014 ක් වූ නොවැම්බර් මස 10 වන දින මාතලේ දඹුල්ලේ දී මෙහි අත්සන් කළ බව  
මෙයින් සැබෑ කොට සහතික කරමි.

තව ද ඉහත පෙහෙත ඔප්පුවේ සඳහන් මුදල මා ඉදිරිපිට දී ගනුදෙනු නොවූ බවත්,

සහ මෙහි දෙවන පිටපතට රුපියල් විසිහත් දහසක් (රු.27,000/-) ක් වටිනා මහජන බැංකුව *අනු-කා* **46**  
ශාඛාවට ගෙවන ලද අංක : PBS / NWP / A 419232 සහ වර්ෂ 2014 ක් වූ නොවැම්බර් මස //  
මෙහි දරණ විවිධ පතක් මෙහි අලවා ඇති බවත් සහ මුල් පිටපතට රුපියලක් වටිනා මුද්දරයක් අලවා ඇති  
බවත් මෙයින් වැඩිදුරටත් සැබෑ කොට සහතික කරමි.

සහතික කළේ වර්ෂ 2014 ක් වූ }  
නොවැම්බර් මස }  
10 වන දින දී ය. }



*[Handwritten Signature]*  
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**ANNEX – 2.4.6**

**Test Blast Report**



**ANNEX – 2.4.6**

**Report**

24<sup>th</sup> JULY  
2020

# NOISE MEASUREMENTS REPORT

FOR

R.S Mine

AT

Maduragoda

## PROJECT PROPONENT

**R.S Mines (Pvt) Ltd.**

Wijekoon House,  
Madipola, Matale.

## INVESTIGATED & PREPARED BY



*GSMB Technical Services (Pvt) Ltd  
190/A, Rathnaweera Building,  
Stanley Thilakarathne Mawatha,  
Nugegoda.*

**GSMB Technical Services (Pvt) Ltd**

(Subsidiary Company of Geological Survey & Mines Bureau)

190/A, Rathnaweera Building, Nugegoda

<b>CONTENTS</b>	<b>Page No.</b>
1.0 Reason for the Measurement .....	2
2.0 Date of Measurement.....	2
3.0 Contacted Person.....	2
4.0 Detail of the Industry.....	2
5.0 Noise Level Measurement .....	3
5.1 Method of Measurement .....	3
5.2 Condition of measurements .....	3
6.0 Observations / Remarks .....	3
6.1 GPS Coordinates of point .....	3
6.2 Weather condition.....	4
6.3 Details of the functioning machines on the measurement day .....	4
7.0 Results .....	4
7.1 Noise measurements for day time.....	4
7.2 Noise measurements for night time .....	5
7.3 Maximum Permissible Levels.....	5
8.0 Conclusion .....	5

**Annexure**

Noise level measured locations



## 1.0 REASON FOR THE MEASUREMENT

The measurements were carried out upon the request of RS Mine Pvt Ltd to perform General Noise test with respect to the BS-4142: 1997 method, by using Noise level meter NL-42 (Type-2) in the RS Mine, Maduragoda.

**2.0 DATE OF MEASUREMENT** - 24<sup>h</sup> of July 2020.

**3.0 CONTACTED PERSON** - Mr. K.G Gamachchi  
Manager  
RS Mine (Pvt) Ltd.

## 4.0 DETAIL OF THE INDUSTRY/COMPANY

**4.1 Name of the Industry** - RS Mine (Pvt) Ltd

**4.2 Type of Industry** - Graphite mine

**4.3 Address** - Maduragoda, Kotuhena, Kurunegala.

**4.4 GPS Coordinate** - 174481 E / 265251 N

**4.5 Started year of the Industry** - -

**4.6 Working Hours** - -

**4.7 Local Authority concerned** - Ridigama Pradhiya saba

## 5.0 NOISE LEVEL MEASUREMENT

### 5.1 Method of Measurements

- According to the BS-4142:1997 method, by using Noise level meter NL-42 (Type 2) Noise levels were measured when the site is under operation and when the site is not in operation.
- GPS coordinates of required Points and distances were taken by using Triton MAGELLAN 610 GPS.

### 5.2 Condition of measurements

The day time noise level measurements were carried out at the required locations and boundary of the site between 1000 hrs to 1230 hrs on 24<sup>th</sup> of July 2020 while the site was under operation and 1230 hrs. to 1330 hrs. (lunch time) on the same day while the site was not in operation.

## 6.0 OBSERVATIONS / REMARKS

### 6.1 GPS Coordinates of points

- General Noise test is performed when the site was in normal operation in the day time at points A, B
- The noise level measuring locations were notified by management of the site.

	Location	GPS Coordinates	
		E	N
A	H-22 S.D.C Edirisinghe	174658	265022
B	H19-Seelwathi	174702	265097

### 6.2 Weather Condition

- 24<sup>th</sup> July 2020 – Day time: Temperature: 30°C / Partly cloudy, Wind: 15km/h SW

### 6.3 Details of the functioning machines on the measurement day

Machine	Items
Air Compressor	01

Reported by GSMB Technical Services (Pvt) Ltd



## 7.0 RESULTS

### 7.1 Noise measurements for day time

0600 hrs. To 2100 hrs. On 24/07/2020

Measured Points (Please see the sketch)	Measured Residual Noise Level $L_{Aeq,T}$ (dB(A))	Measured Noise Level when Machines are operating $L_{Aeq,T}$ (dB(A))	Measured Noise Level with Correction dB(A)
A	51	51	**
B	50	50	**

*Note: - Above readings are valid only for the date of the measurements*

*Measurements on field are rounded off for the calculations*

*\*\* - No Additional Contribution to the residual Noise level*

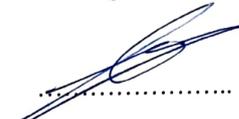
### 7.3 Maximum Permissible Levels

According to the National Environment (Noise Control) regulations No.1 of 1996 which published by the government Gazette No 924/12 dated 23/05/1996 under Schedule III, the maximum permissible noise level for this construction site is 75 dB for day time & 50 dB for night time.

## 8.0 CONCLUSION

- According to the corrected noise levels in day times & night times given in item 7.1, There was no additional contribution to the residual noise level from the source & not exceeded at the points A, B during Day time

Investigated & Prepared by: -

  
.....  
D.A.I.A Jayasekara

Mining Engineer

GSMB Technical Services (Pvt) Ltd.

**GSMB Technical Services (Pvt) L**  
190/A, Rathnaweera Building,  
Stanley Thilakarathne Mawatha,  
Nugegoda.

Reported by GSMB Technical Services (Pvt) Ltd

**Annexure**

**Noise level measured location**



Reported by GSMB Technical Services (Pvt) Ltd |||

**ANNEX – 2.4.8**

**Detailed Landslide Investigation Report**

KU/LRAP/45000/2020/00045

**Landslide Hazard Investigation Report of the RS  
Graphite Mine in Kotuhena, Rideegama in  
Kurunegala District**

2020.07.13



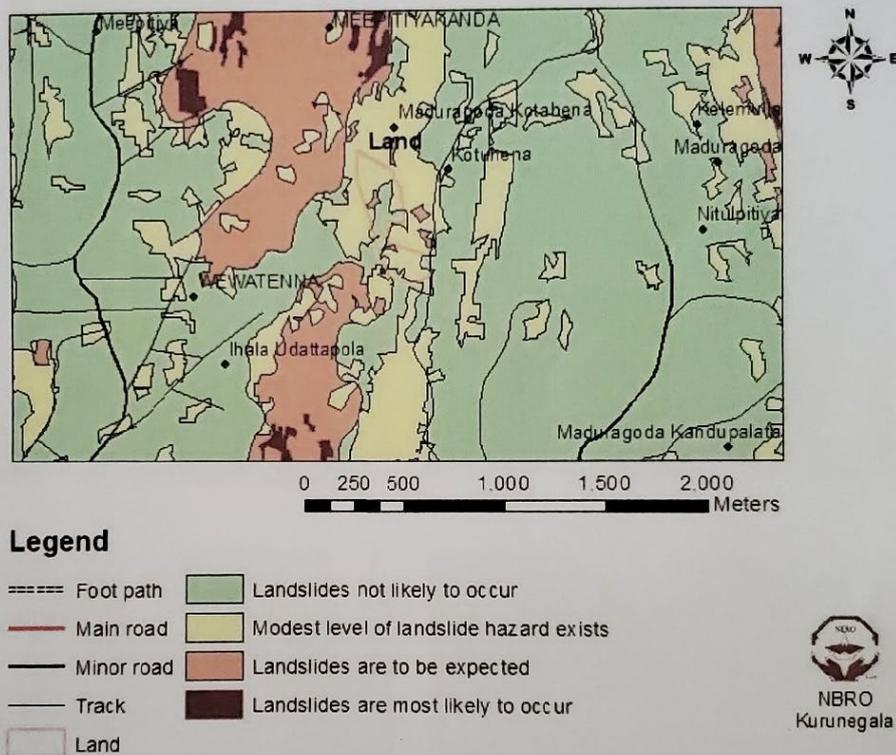
DISTRICT OFFICE  
NATIONAL BUILDING RESEARCH ORGANISATION  
NO 32, MUHAMDIRAM WEERATHUNGA MAWATHA  
NEGAMBO ROAD,  
KURUNEGAL.

T.P. : (037) – 2229485  
Email : [nbro.kurunegala@gmail.com](mailto:nbro.kurunegala@gmail.com)



### 3.0 Field Observations

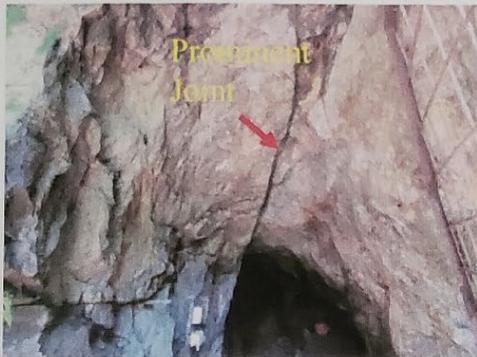
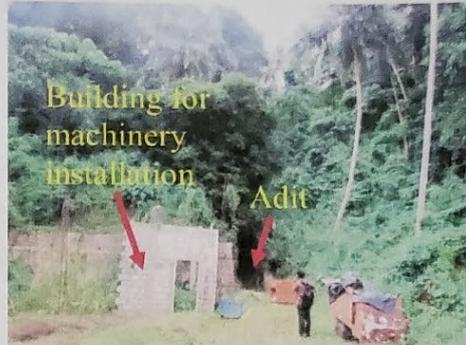
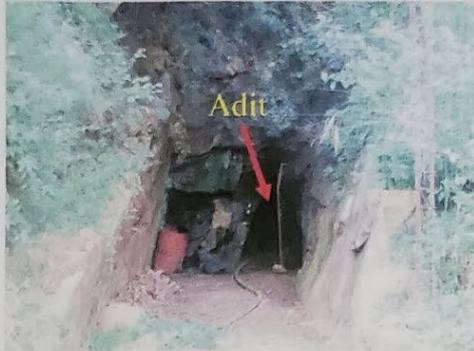
1. Total land is having an extent of about 8A 2R 26P which described in the survey plan No: 5652 made by licensed surveyor Mr.R.M.Jayasundara (Attached).
2. According to the landslide hazard zonation map published by the NBRO at a scale of 1:50000, this area mostly belongs to "Modest level of landslide hazard exists" category and therefore, there is predisposition of landslides if hap hazard developments are done (Please refer Fig.2).



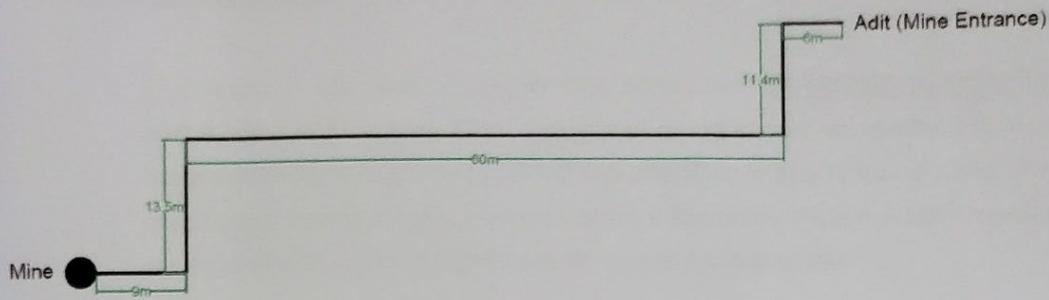
**Fig.2: Landslide hazard zonation map of the area**

3. Project area is a forested land having a general gradient of about 25°.
4. Bedrock can be categorized as quartzo-feldspathic gneiss and according to the visual observations, graphite vein is intruded in N70°W / 70°SW (Strike / Dip) joint plane.
5. The mine has been started in 2007 and currently been abandoned. Adit, mine shaft and cross cuts are available as shown in Fig.5.

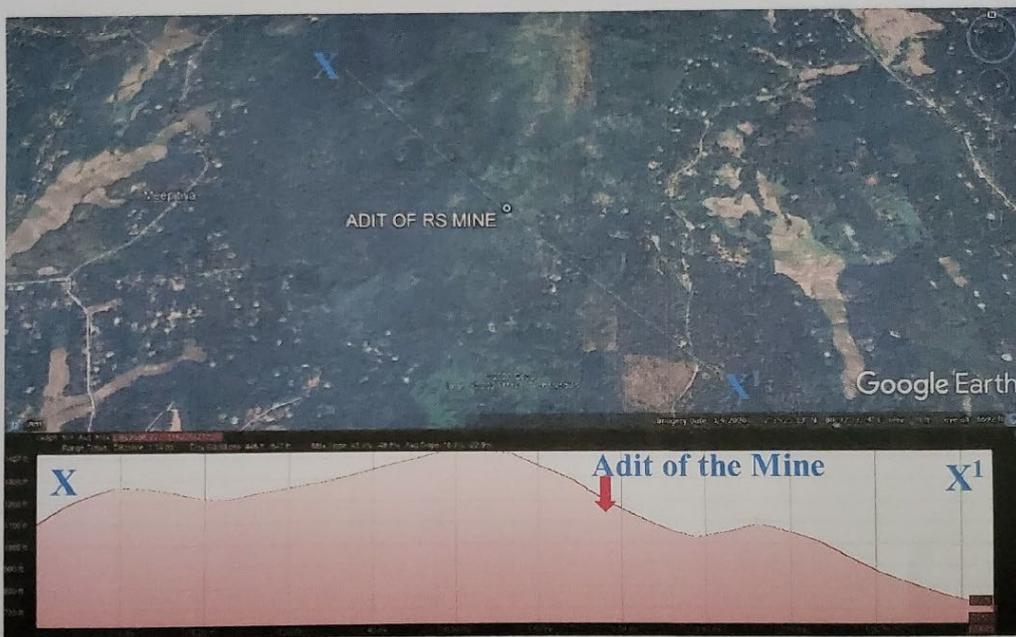
6. No human settlements could be observed in the near vicinity of the project area.



**Fig.3: Photographs of the mine and surrounding area**



**Fig.4: Dimensions of the existing Adit and Shafts**



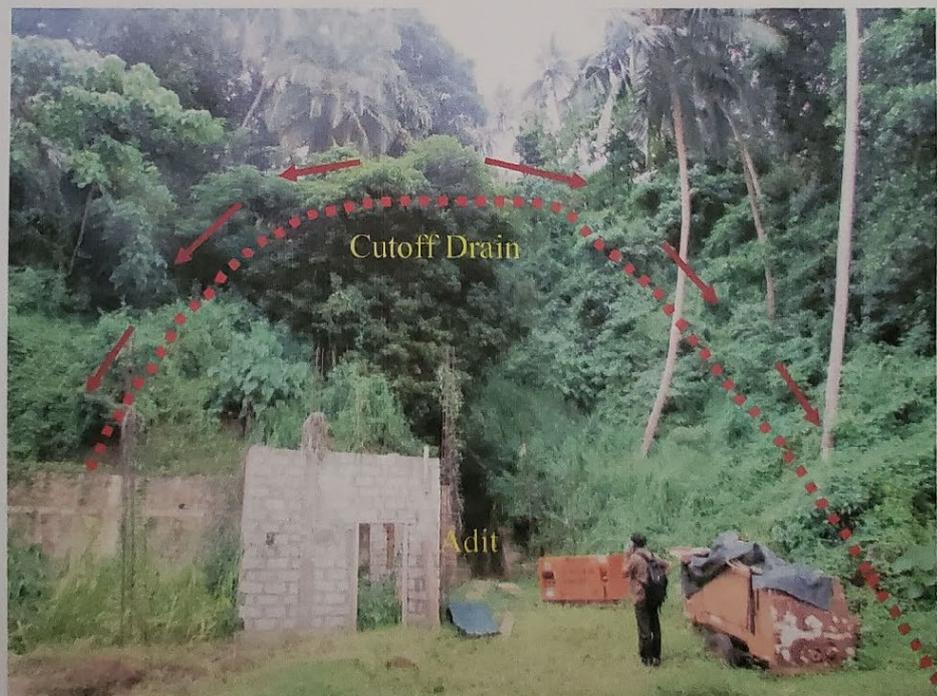
**Fig.5: Cross sectional view of the project area**

#### 4.0 Conclusion

Based on the data gathered / observations made during field inspection and experience of landslide hazards, this project can be accepted from landslide hazard aspect. However, the following recommendations should definitely be followed during mining / later phases of the project.

## 5.0 Recommendations

1. This report is valid only for 1-year time period from **01/08/2020 to 01/08/2021** and if this proceeds thereafter, a technical report should be obtained from our organization regarding the stability of the site. This is due to that altering of the morphology during excavations may arise instabilities. Please make necessary arrangements to apply at least 1 month before the expiry date.
2. The loose, unstable rock blocks on top of the adit should be removed prior to implementing the mining or any stabilization work. Adit facing should be well concreted under qualified engineering supervision. In problematic situations please do not hesitate to consult the NBRO.
3. Natural storm water paths below the project area should not be blocked by any kind of construction or waste dumping. Proper surface drainage system (Rubble pitched) should be supplied for free draining of surface water
4. Rubble masonry Cutoff drain (0.6m×0.6m) should be supplied above the Adit as shown in Fig.6 to avoid erosion by rain water.



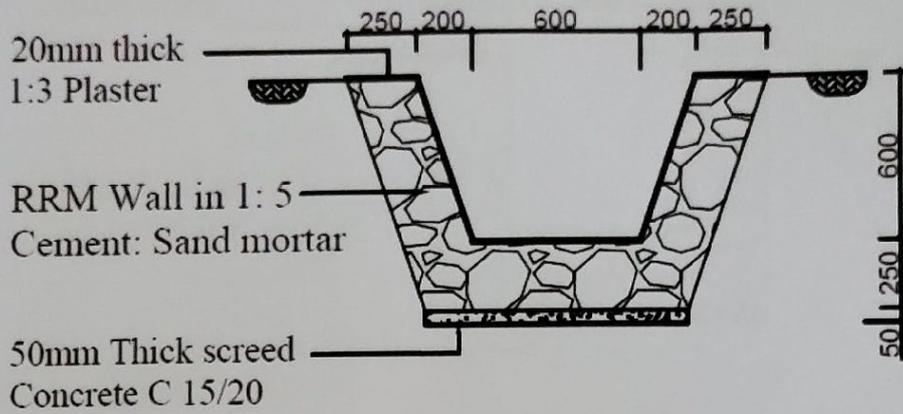
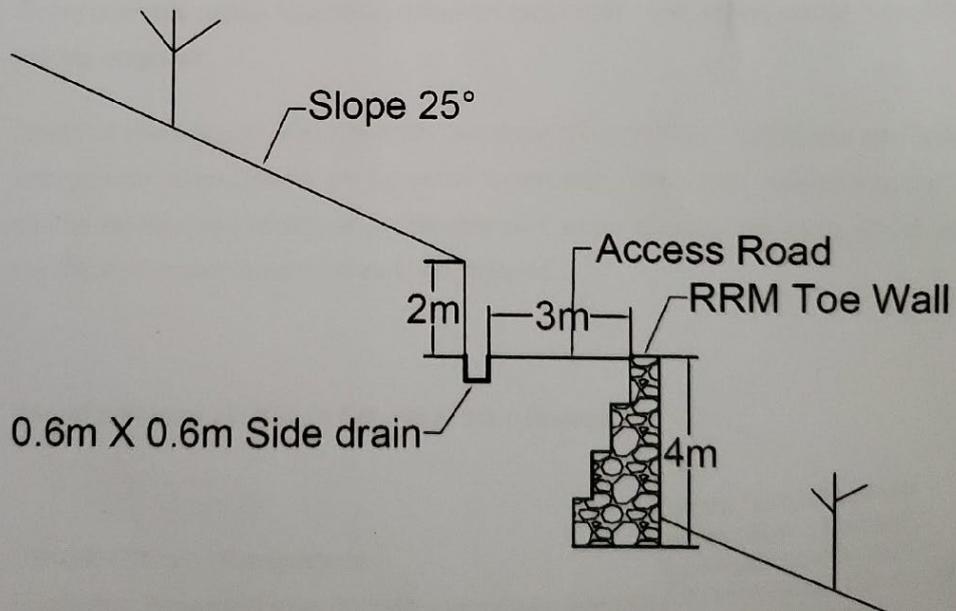
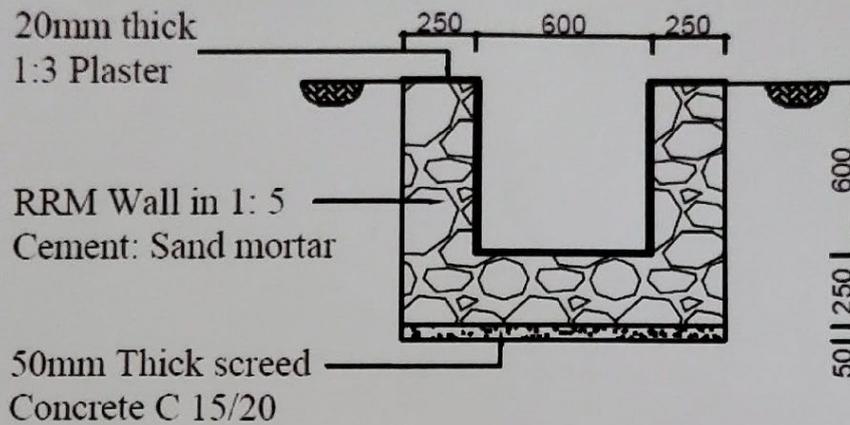


Fig.6: Cutoff drain location above the Adit and typical 0.6m×0.6m RRM drain details

5. Access road should be developed with 0.6m×0.6m side drains as shown in Fig. 7.

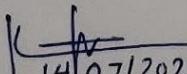




**Fig.7: Method of access road development and typical 0.6m×0.6m side drain details**

6. All the blasting procedures should be done according to the recommendations given by the Geological Survey and Mines Bureau (GSMB).
7. Every possible action should be taken for labor and mine safety under a qualified mining engineer.
8. Roots of trees and shrubs generally enhance the stability of soil slope and grass and ground cover reduce the potential for erosion. Therefore, natural vegetation should be retained wherever practicable and when clearing for excavation, only the minimal areas required should be stripped.

Report prepared by: Kelum Senevirathna (Geologist)

  
.....14/07/2020.....

**District Officer - Kurunegala**

**Landslide Research and Risk Management Division**

**National Building Research Organization**

**Kelum Senevirathna**  
District Officer / Geologist  
Kurunegala District Office  
National Building Research Organization  
Ministry of Defence

**ANNEX – 3.1.1.3.2**

**Chemical and Physical Water Quality Parameters  
Of Groundwater (DW1 Well) and  
Surface Water (Kirindi Oya)**



## **ANNEX – 3.2.2**

### **Recorded Flora Species within the Project Area**



**ANNEX – 3.2.2A**

**Recorded Fauna Species within the Project Area**



**ANNEX – 3.2.2B**

**Some Ecologically Important Photographs  
of the Project Area**



**ANNEX – 4.2.1.2**

**Pre Crack Survey Report**



JULY  
2020

**PRE CRACK SURVEY REPORT**  
**FOR**  
**THE BUILDING SITUATED WITHIN 500m RADIOUS**  
**AROUND THE R.S MINE**  
**AT**  
**Maduragoda**

**PROPRIETOR**

R.S Mines (Pvt) Ltd.  
Wijekoon House,  
Madipola, Matale.

**INVESTIGATED & PREPARED BY**



Technical Services (Pvt) L  
190/A, Rathnaweera Building,  
Stanley Thilakarathne Mawatha,  
Nugegoda

**GSMB Technical Services (Pvt) Ltd**  
(Subsidiary Company of Geological Survey & Mines Bureau)  
190/A, Rathnaweera Building, Nugegoda

**CONTENTS****Page No****CHAPTER 01 – Introduction**

1. Introduction	02
2. Objectives	02
3. Methodology	02
4. Limitations	03

**CHAPTER 02 – Outline of the Report**

1. Outline of the report	04
2. Name list of the houses in the surveyed area	04

## **CHAPTER 01 – Introduction**

### **1. Introduction**

A request made by R.S Mines (Pvt) Ltd to GSMB Technical Services (Pvt) Ltd to undertake the Crack survey involved with mining activities at RS Mine Maduragoda. Accordingly, the investigation was performed on 23 selected houses of which the pre crack survey was conducted. The Survey was carried out by GSMB Technical Services (Pvt.) Ltd.

### **2. Objectives**

The major objective of the survey is to identify the structural damages to close by houses due to mining activities. Other objectives include ascertaining the damages to the houses by vibration and renovate the damages as the houses appeared before the mining activities.

### **3. Methodology**

Cracks were marked and recorded using a combination of Visual Inspection and Photography. In this method, all existing cracks were recorded. Apart from the cracks, special cases such as plaster/wall damages, glass damages, tile damages, roof damages were also recorded additionally in an accountable/measurable way. The inspection procedure of a particular structure was divided into two i.e. Exterior Inspection and Interior Inspection. During Exterior Inspection, Floor, Frames, painted or masonry construction, type of Roof, Gutters were noted while Interior Inspection, every inch of the structure/house was inspected, recorded & described accordingly.

#### **4. Limitations**

- a. It should be noticed that all the measurements and photographs were taken from visible cracks to the naked eye. But there may be micro cracks and old cracks, which have been re-plastered.
- b. The measured lengths and thickness of cracks will be valid for the date of observation. Therefore, the propagation of the cracks should be monitored periodically. Length of cracks will be measured in between two ends of a crack & it will be the nearest.

## **CHAPTER 02 – Outline of the report**

### **1. Outline of the Report**

The first chapter of the report includes a general introduction of the survey, objectives, methodology & limitations. The core of the report is contained in Chapter 02 where all data collected during fieldwork is described & presented.

Location :RS Mine-Maduragoda  
 House No : H 01  
 Name :Public well 01  
 Address :Udaththapala,Maduragoda

## GPS Coordinate:

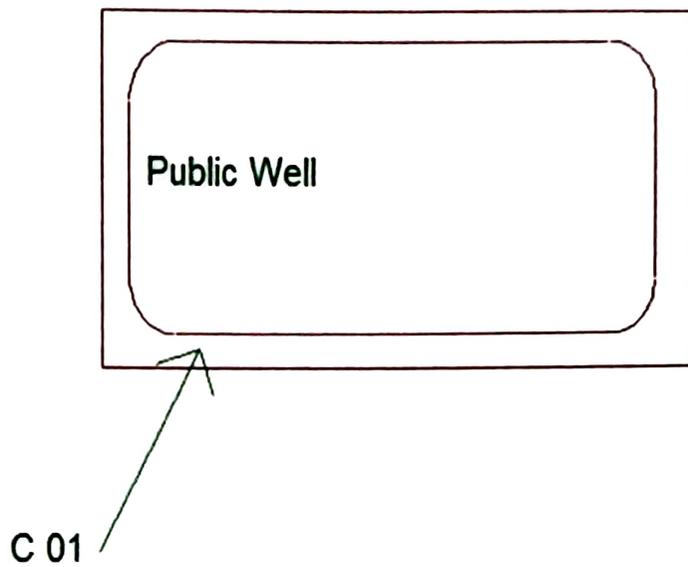
E – 174724

N – 265132

Inspected Date:-22-07-2020



(1) Identification number of house:	H 01	
(2) Photo notation:	H <sup>RS Mine</sup> -01-01	
(3) Approximate age of the house:	-	
(4) Details of the land in which house was built on:	Existing ground	
(5) Existing structural detail		
5.1 Detail of the roof:	-	
5.2 Detail of the walls:	5.2.1 Material type:	-
	5.2.2 Thickness:	-
5.3 Detail of the plaster:	-	
5.4 Detail of the windows:	-	
5.5 Details of floor	-	
5.6 Details of foundation	-	



**Plan view of H-01**

(6) Details of cracks at the Pre-Survey

Pre-Survey			Remarks
Crack No	Length (cm)	Thickness (mm)	
C 01	30*25		Crack on the top

MJC – Major Crack

C- Crack

MC – Minor crack



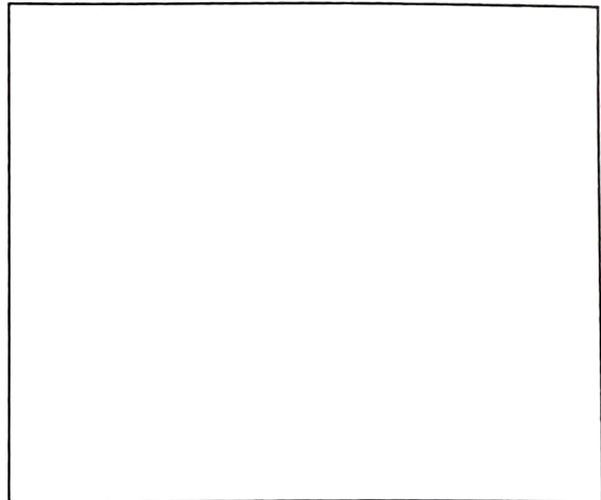
**C01**

**Location** :RS Mine-Maduragoda  
**House No** : H 09  
**Name** :G.G Anura Kumara  
**Address** :Udaththapala, Maduragoda  
**GPS Coordinate:**

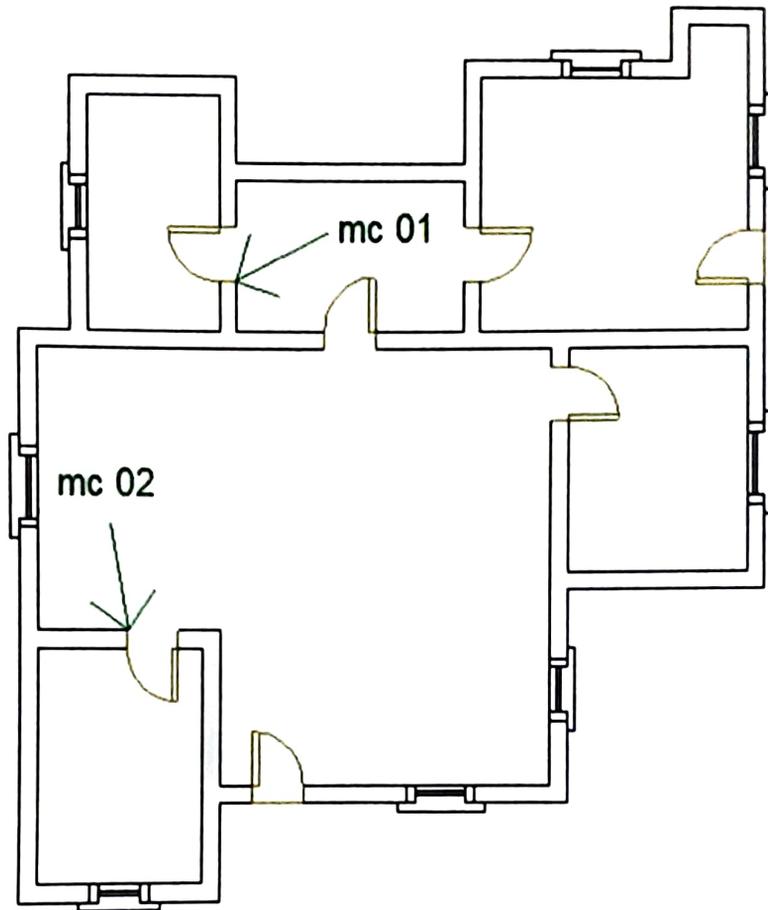
E – 174960

N – 265108

**Inspected Date:-22-07-2020**



<b>(1) Identification number of house:</b>	H 09	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> -09	
<b>(3) Approximate age of the house:</b>	04 years	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Asbestos sheets	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness:</b>	-
<b>5.3 Detail of the plaster:</b>	Both side	
<b>5.4 Detail of the windows:</b>	Wooden & Glass	
<b>5.5 Details of floor</b>	Concreted & Tiled	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-09**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
MC 01	20	Minor	Upward from left side of the door frame
MC 02	18	Minor	Upward from right side of the door frame

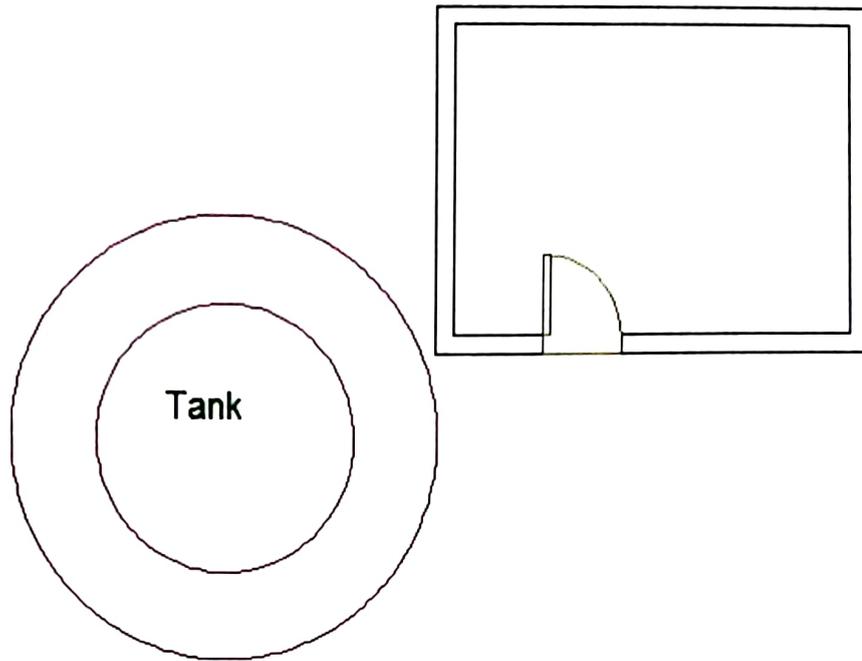
**MJC – Major Crack      C- Crack      MC – Minor crack**

**Location** : RS Mine-Maduragoda  
**House No** : H 11  
**Name** : Storage Tank  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E – 174911  
 N – 265091



**Inspected Date:-**23-07-2020

<b>(1) Identification number of house:</b>	H 11	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 11	
<b>(3) Approximate age of the house:</b>	01 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Slab	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness :</b>	-
<b>5.3 Detail of the plaster:</b>	Both side	
<b>5.4 Detail of the windows:</b>	-	
<b>5.5 Details of floor</b>	Cemented	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-11**

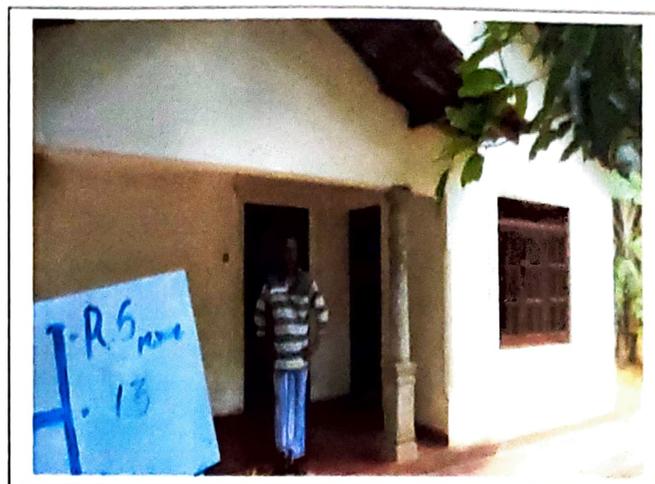
<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracked & damaged at inspection time

**MJC – Major Crack**

**C- Crack**

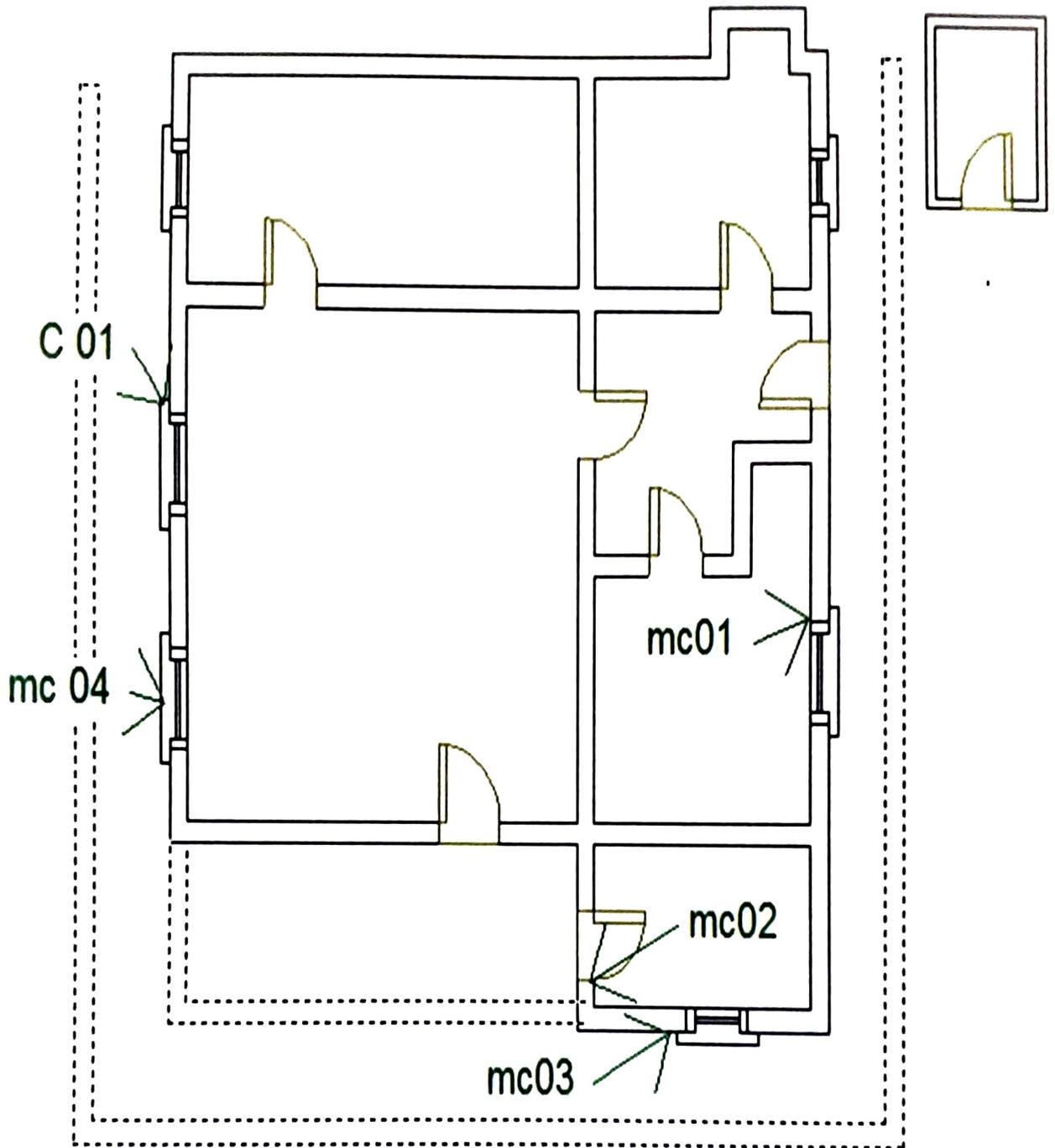
**MC – Minor crack**

**Location** :RS Mine-Maduragoda  
**House No** : H 13  
**Name** :W PremaMallika  
**Address** :Udaththapala,Maduragoda  
**GPS Coordinate:**  
**E** - 174867  
**N** - 265130



**Inspected Date:-21-07-2020**

<b>(1) Identification number of house:</b>	H 13	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> -19-23	
<b>(3) Approximate age of the house:</b>	10years	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Roof tiles standard& Slab	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness:</b>	-
<b>5.3 Detail of the plaster:</b>	Both side	
<b>5.4 Detail of the windows:</b>	Wooden & Glass	
<b>5.5 Details of floor</b>	Cemented	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



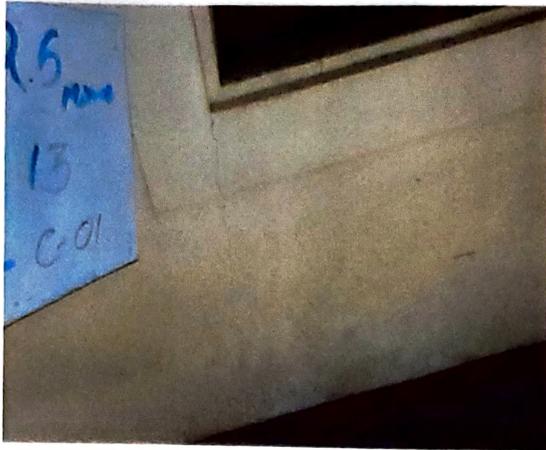
Plan view of H-04-Ground floor

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
MC 01	26	Minor	Downward from left side of the window frame-both side
MC 02	42	Minor	Upward from left side of the door frame
MC 03	45	Minor	Downward from left side of the window frame
MC 04	75	Minor	Downward from middle of the window frame
MC 05	101	Minor	Downward from right side of the window frame
C 01	75	01	Downward from left side of the window frame
P	100*50		Pavement has been cracked

MJC – Major Crack

C- Crack

MC – Minor crack



C1



P

**Location** :RS Mine-Maduragoda  
**House No** : H 15  
**Name** :P.D Athula weerasinghe  
**Address** :Udaththapala,Maduragoda  
**GPS Coordinate:**

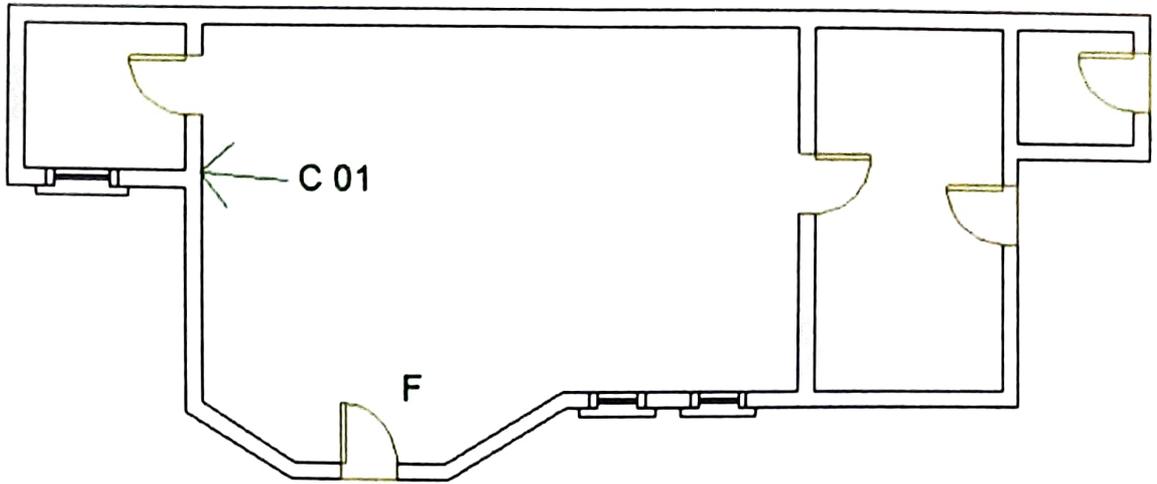
E – 174844

N – 265140

**Inspected Date:-21-07-2020**



<b>(1) Identification number of house:</b>	H 15	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> -15-01	
<b>(3) Approximate age of the house:</b>	12 years	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Roof tiles standard& Slab	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks& Cement blocks
	<b>5.2.2 Thickness:</b>	-
<b>5.3 Detail of the plaster:</b>	Some part	
<b>5.4 Detail of the windows:</b>	Window frame only	
<b>5.5 Details of floor</b>	Concreted& Soil Compacted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	

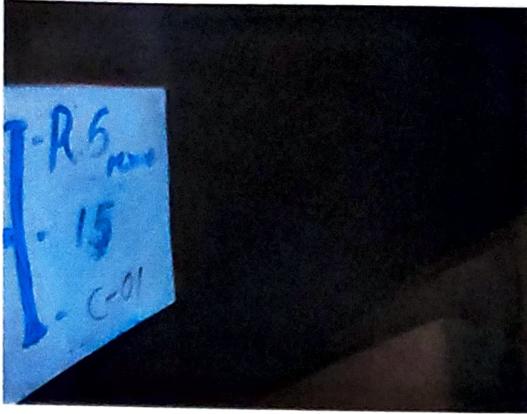


**Plan view of H-15**

.....

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
C 01	82	01	Downward from top to bottom on the wall –both side
F	-	-	Floor has been damaged

**MJC – Major Crack****C- Crack****MC – Minor crack**



C 01



A

**Location** : RS Mine-Maduragoda  
**House No** : H 16  
**Name** : Upul Shantha Gunasinghe  
**Address** : Kotuhena, Udaththapala  
 Maduragoda  
**GPS Coordinate:**

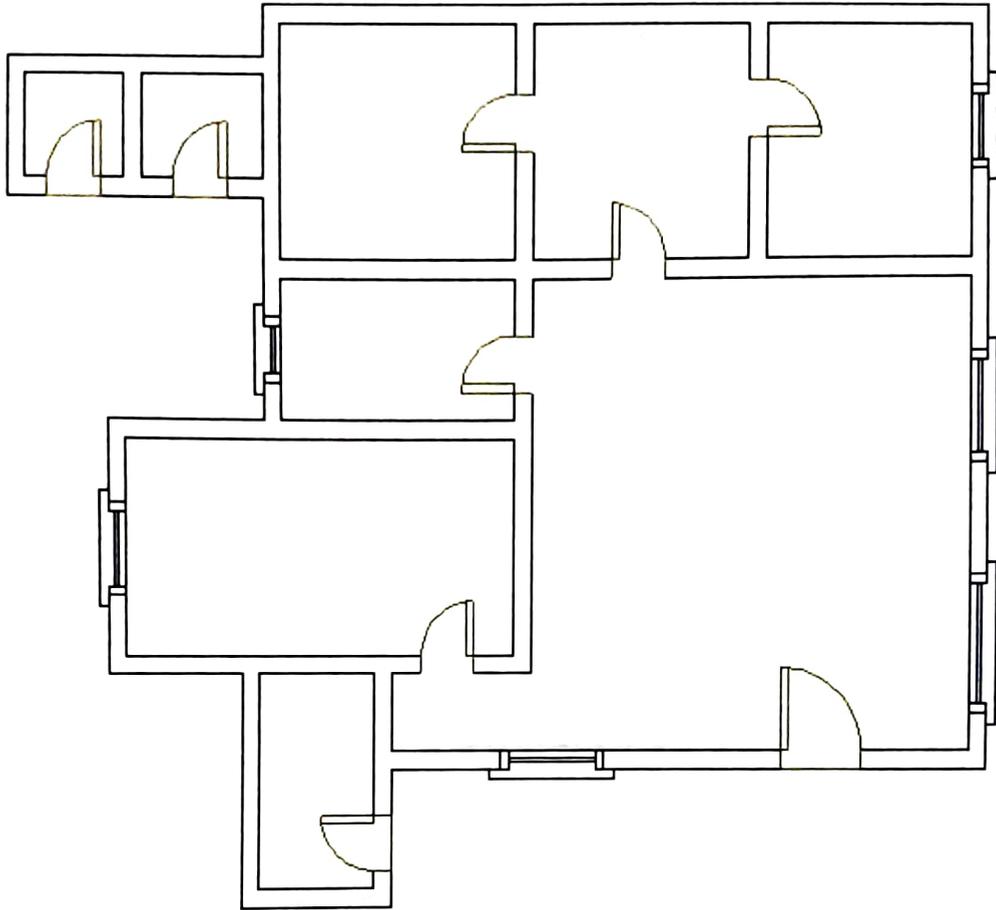
E – 174872

N – 265215

**Inspected Date:**-20-07-2020



<b>(1) Identification number of house:</b>	H 16	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 16	
<b>(3) Approximate age of the house:</b>	10 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Roof tiles standard	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness :</b>	130mm
<b>5.3 Detail of the plaster:</b>	Some part	
<b>5.4 Detail of the windows:</b>	Window frame only	
<b>5.5 Details of floor</b>	Concreted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-16**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracked & damaged at inspection time

**MJC – Major Crack****C- Crack****MC – Minor crack**

**Location** :RS Mine-Maduragoda  
**House No** : H 17  
**Name** :Public well 02  
**Address** :Udaththapala,Maduragoda

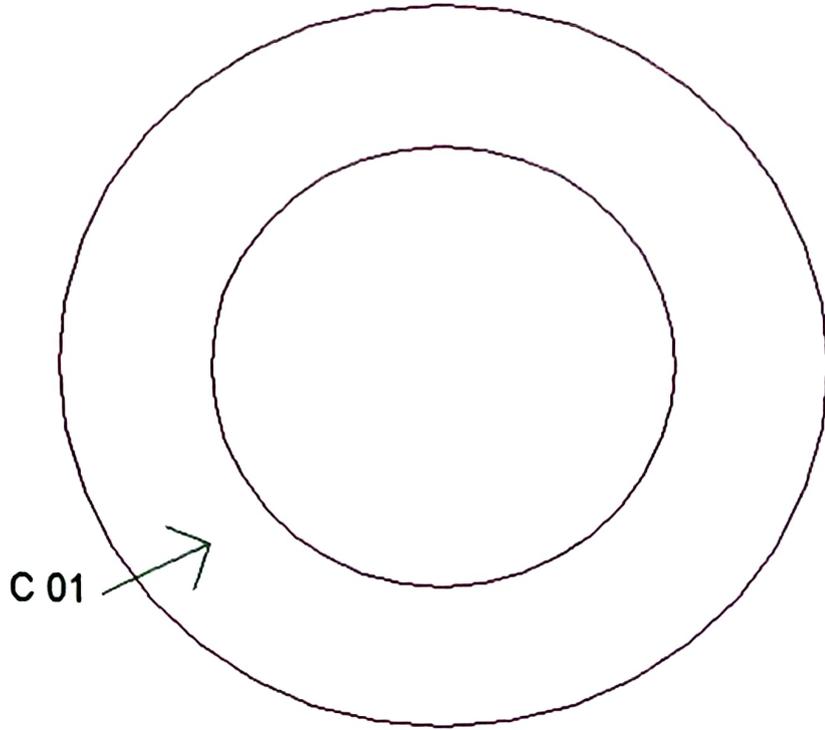
**GPS Coordinate:**

E – 174836

N – 265166

**Inspected Date:-22-07-2020**

<b>(1) Identification number of house:</b>		H 17
<b>(2) Photo notation:</b>		H <sup>RS Mine</sup> -17-01
<b>(3) Approximate age of the house:</b>		15 years
<b>(4) Details of the land in which house was built on:</b>		Existing ground
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	-	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	stones
	<b>5.2.2 Thickness:</b>	-
<b>5.3 Detail of the plaster:</b>	-	
<b>5.4 Detail of the windows:</b>	-	
<b>5.5 Details of floor</b>	-	
<b>5.6 Details of foundation</b>	-	

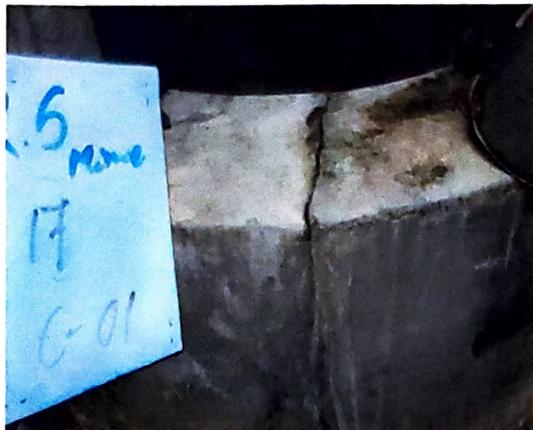


**Plan view of H-17**

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<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
C 01	49	01	Crack on the top

**MJC – Major Crack      C- Crack      MC – Minor crack**



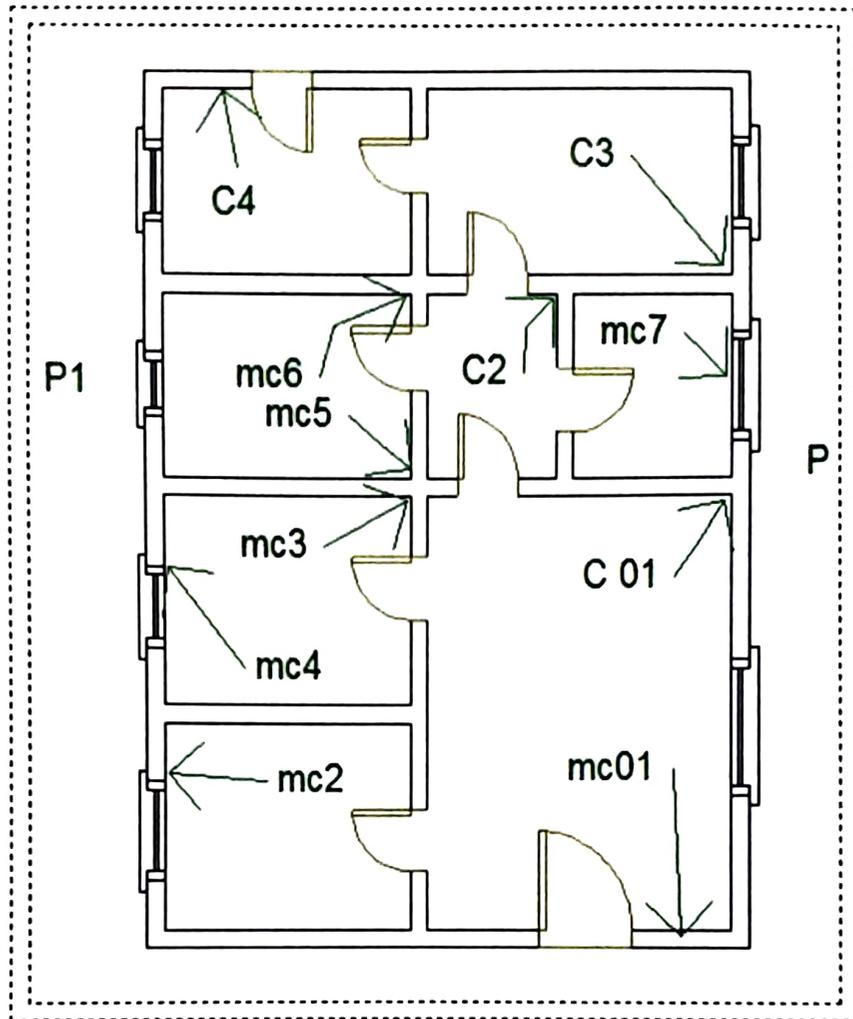
C 01

Location :RS Mine-Maduragoda  
 House No : H 19  
 Name :Seelawathi  
 Address :Udaththapala,Maduragoda  
 GPS Coordinate:  
 E – 174702  
 N – 265097



Inspected Date:-21-07-2020

(1) Identification number of house:	H 19	
(2) Photo notation:	H <sup>RS Mine</sup> -19-23	
(3) Approximate age of the house:	30years	
(4) Details of the land in which house was built on:	Existing ground	
(5) Existing structural detail		
5.1 Detail of the roof:	Roof tiles standard	
5.2 Detail of the walls:	5.2.1 Material type:	Bricks
	5.2.2 Thickness:	-
5.3 Detail of the plaster:	Both side	
5.4 Detail of the windows:	Wooden & Glass	
5.5 Details of floor	Cemented	
5.6 Details of foundation	Rubble & Masonry	



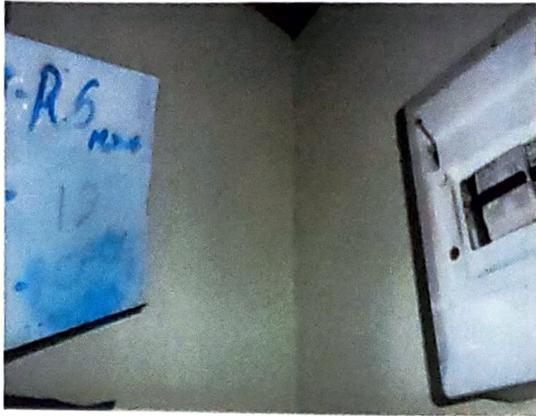
Plan view of H-19

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
MC 01	29	Minor	Downward from top to bottom on the wall
MC 02	87	Minor	Downward from right side of the window frame
MC 03	143	Minor	Downward from top to bottom along the wall joint
MC 04	43	Minor	Downward from right side of the window frame
MC 05	53	Minor	Downward from top to bottom along the wall joint
MC 06	124	Minor	Downward from top to bottom along the wall joint –both side
MC 07	57	Minor	Downward from middle of the window frame
C 01	108	01	Downward from top to bottom along the wall joint
C 02	103	01	Downward from top to bottom along the wall joint –both side
C 03	216	01	Downward from top to bottom along the wall joint
C 04	142	01	Downward from top to bottom on the wall-both side
P	820*100		Pavement has been cracked
P 01	-	-	Pavement has been damaged

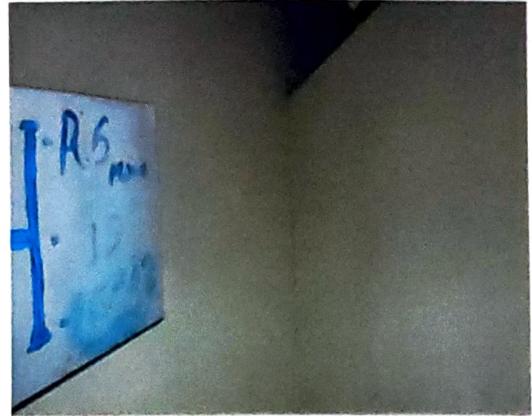
MJC – Major Crack

C- Crack

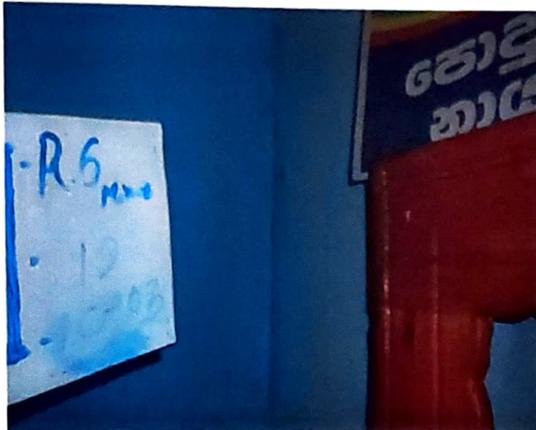
MC – Minor crack



C 01



C 02



C 03



P



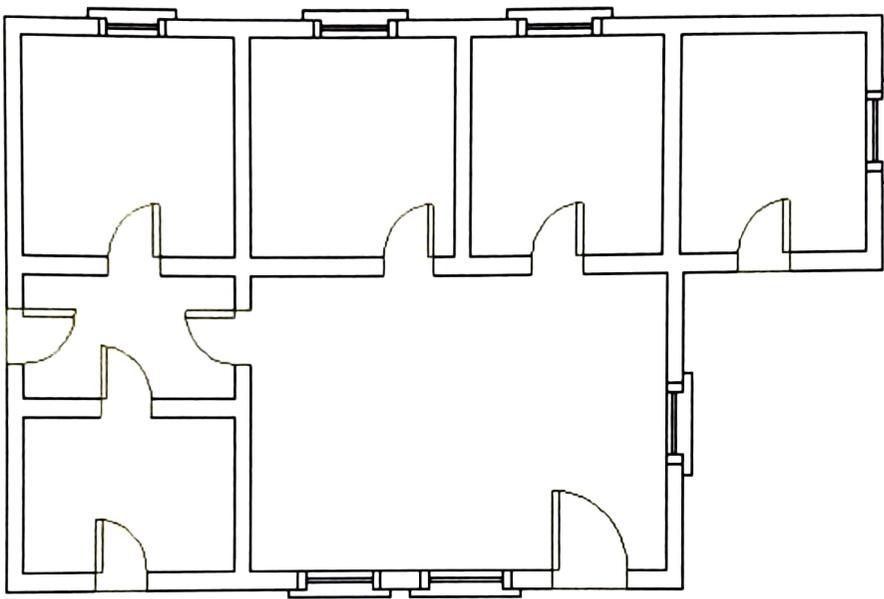
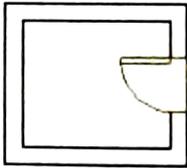
P 1

**Location** : RS Mine-Maduragoda  
**House No** : H 20  
**Name** : Swarnathilaka  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E – 174735  
 N – 265052



**Inspected Date:-**21-07-2020

<b>(1) Identification number of house:</b>	H 20	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 20	
<b>(3) Approximate age of the house:</b>	06 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Roof tiles standards	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness :</b>	-
<b>5.3 Detail of the plaster:</b>	no	
<b>5.4 Detail of the windows:</b>	Wooden & Glass	
<b>5.5 Details of floor</b>	Concreted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-20**

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<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracked & damaged at inspection time

MJC – Major Crack

C- Crack

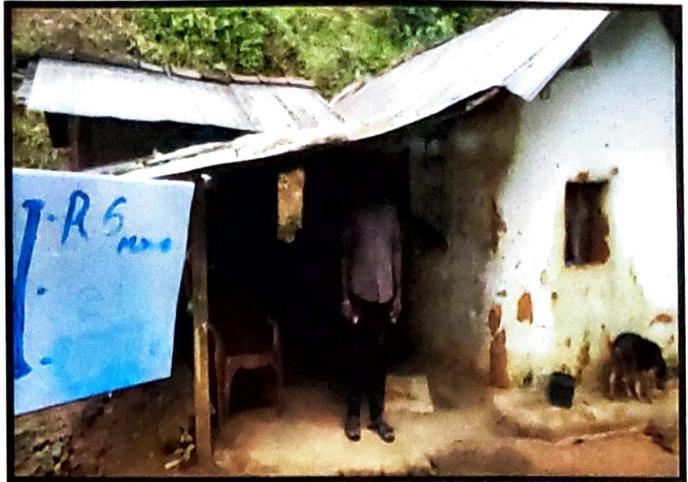
MC – Minor crack

**Location** : RS Mine-Maduragoda  
**House No** : H 21  
**Name** : Nimal Karunathilaka  
**Address** : Kotuhena, Udaththapala  
 Maduragoda  
**GPS Coordinate:**

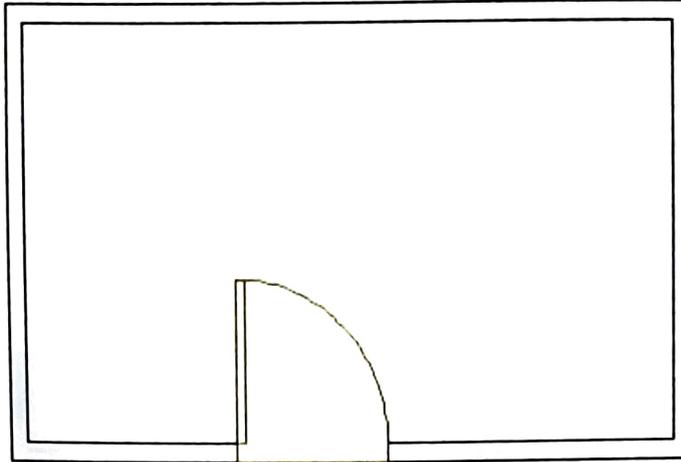
E - 174701

N - 265032

**Inspected Date:**-22-07-2020



<b>(1) Identification number of house:</b>	H 21	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 21	
<b>(3) Approximate age of the house:</b>	25 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Corrugated sheets	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Daub & Wattle
	<b>5.2.2 Thickness :</b>	-
<b>5.3 Detail of the plaster:</b>	-	
<b>5.4 Detail of the windows:</b>	-	
<b>5.5 Details of floor</b>	Soil Compacted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-21**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	The House was constructed by daub & wattle

**MJC – Major Crack**

**C- Crack**

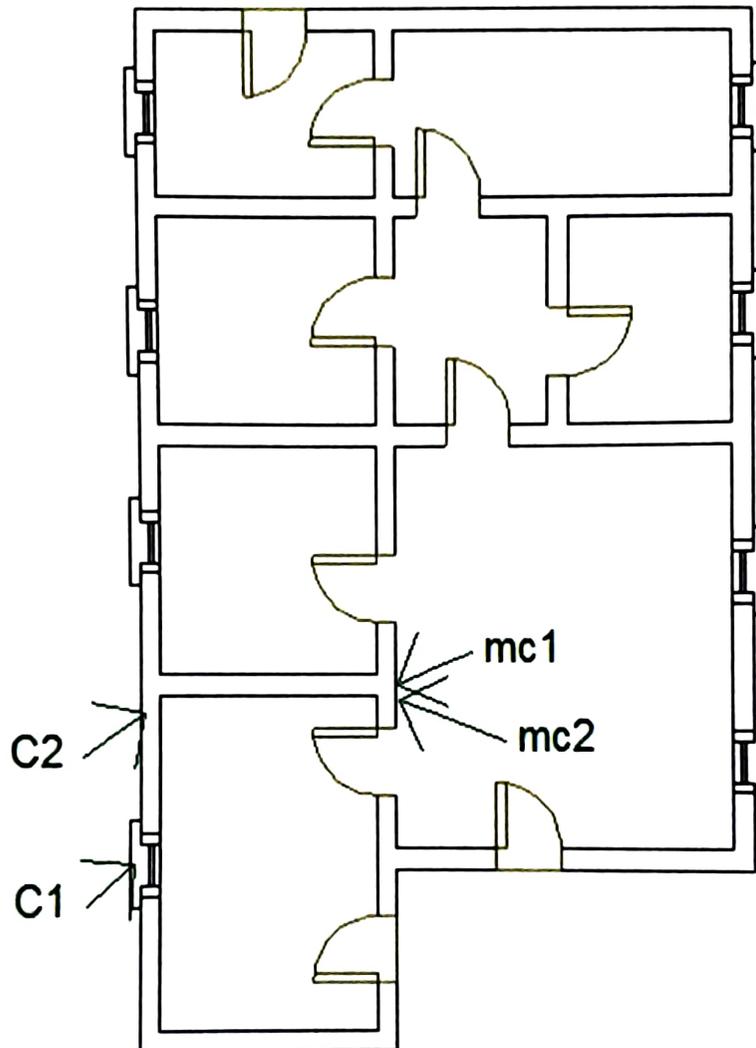
**MC – Minor crack**

**Location** : RS Mine-Maduragoda  
**House No** : H 22  
**Name** : S.D Chalana Edirisinghe  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E – 174658  
 N – 265022



**Inspected Date:**-23-07-2020

<b>(1) Identification number of house:</b>	H 22	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 22-2	
<b>(3) Approximate age of the house:</b>	15 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Asbestos sheet & tiled Standard	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Cement block
	<b>5.2.2 Thickness :</b>	130mm
<b>5.3 Detail of the plaster:</b>	Both side	
<b>5.4 Detail of the windows:</b>	Wooden & Glazed	
<b>5.5 Details of floor</b>	Cemented	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-22**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
MC 01	243	Minor	Downward from top to bottom on the wall
MC 02	41	Minor	Downward from top to bottom on the wall
C 01	109	01	Horizontally on the wall
C 02	253	01	Downward from top to bottom on the wall

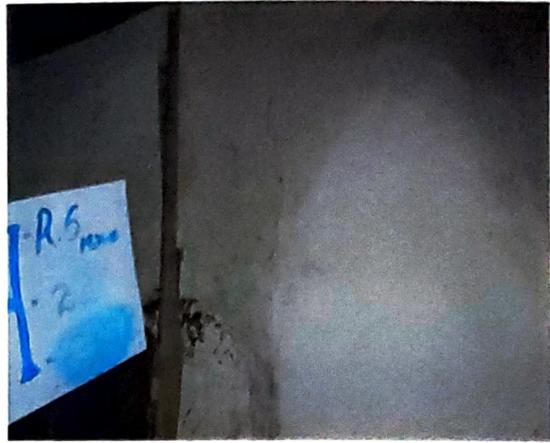
MJC – Major Crack

C- Crack

MC – Minor crack

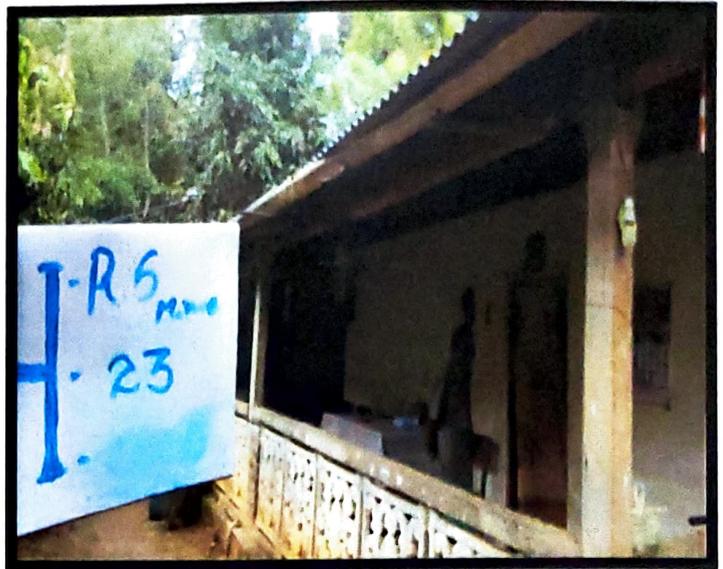


C 01



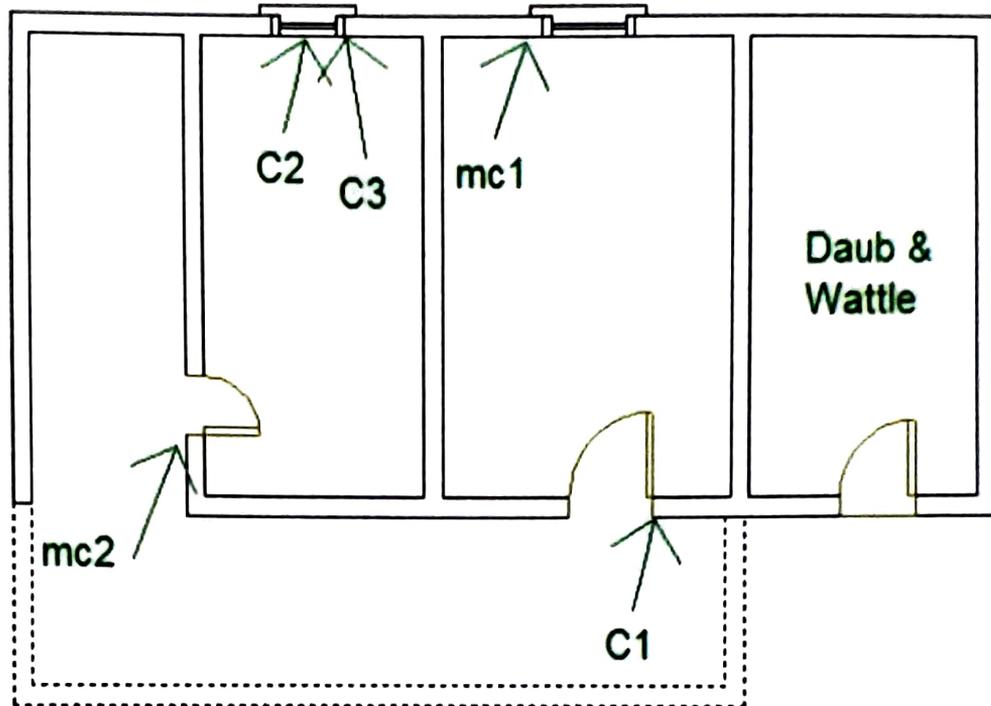
C 02

**Location** : RS Mine-Maduragoda  
**House No** : H 23  
**Name** : Kamala Pathirana  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E – 174675  
 N – 264993



**Inspected Date:**-23-07-2020

<b>(1) Identification number of house:</b>	H 23	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 23-3	
<b>(3) Approximate age of the house:</b>	08 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Corrugated sheets	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Cement blocks & Bricks
	<b>5.2.2 Thickness :</b>	130mm
<b>5.3 Detail of the plaster:</b>	Both side	
<b>5.4 Detail of the windows:</b>	Wooden & Glazed	
<b>5.5 Details of floor</b>	Cemented & Concreted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



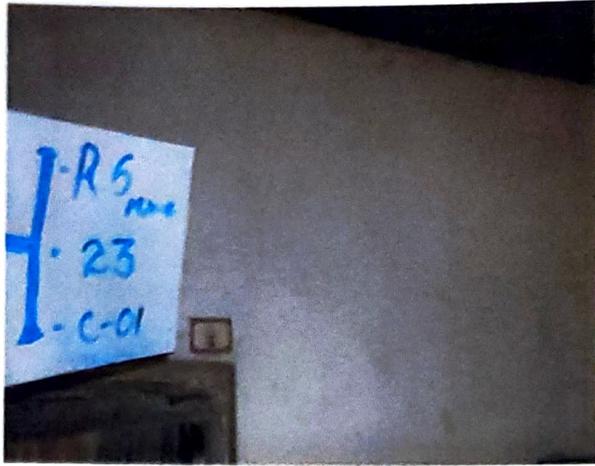
Plan view of H-23

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
MC 01	56	Minor	Downward from left side of the window frame
MC 02	27	Minor	Horizontally from right side of the door frame
C 01	59	01	Upward from left side of the door frame- <b>Both side</b>
C 02	70	02	Upward from middle of the window frame- <b>Both side</b>
C 03	86	01	Downward from left side of the window frame- <b>Both side</b>

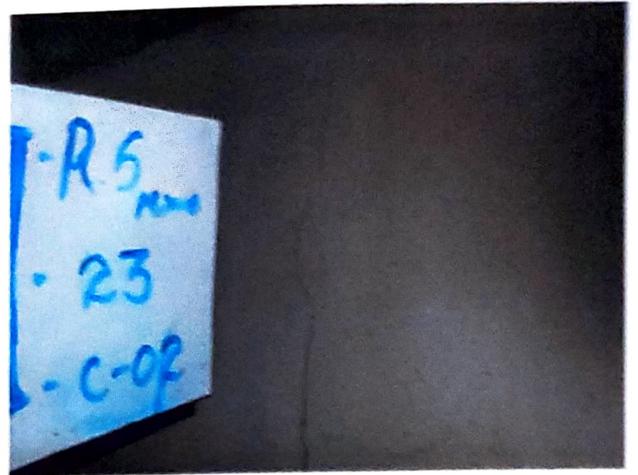
MJC – Major Crack

C- Crack

MC – Minor crack



C 01



C 02

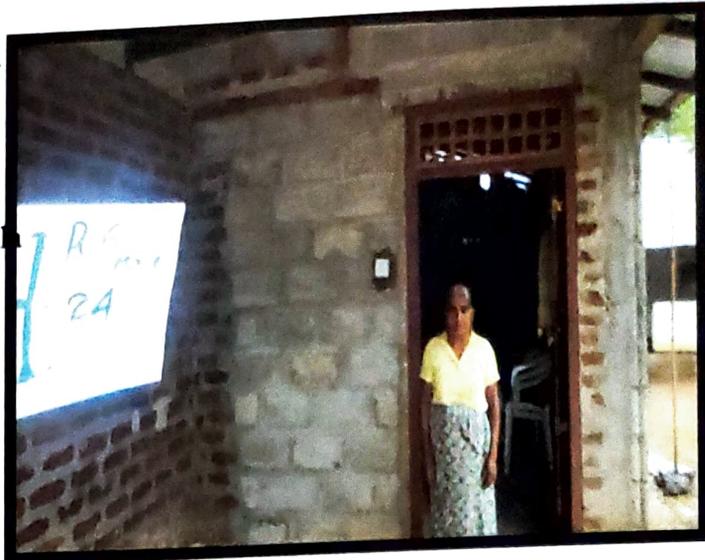


C 03

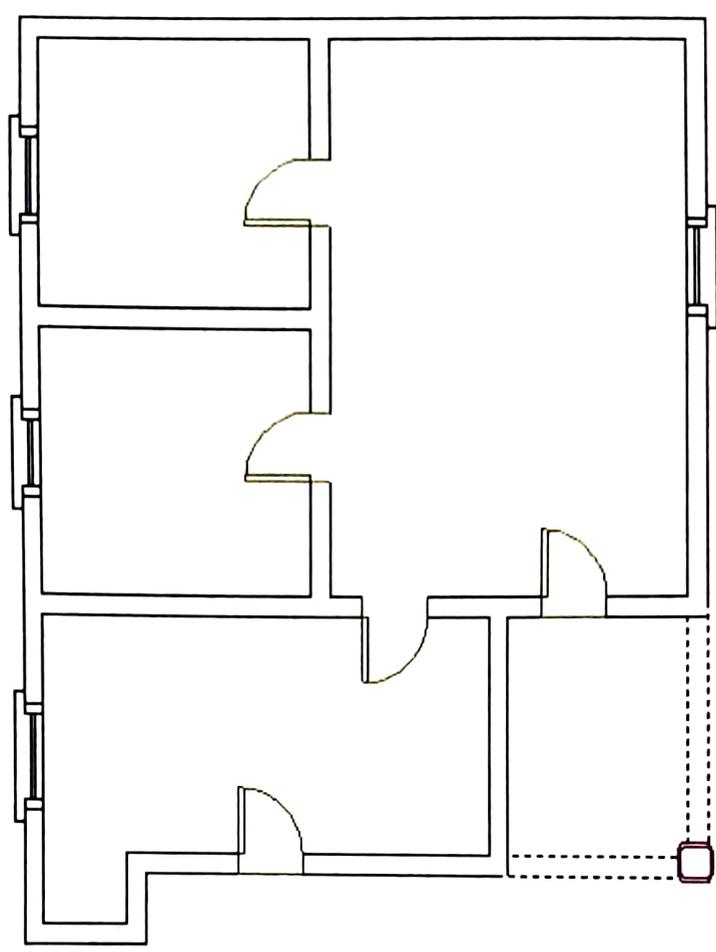
*Pre crack Survey Report***Location** : RS Mine-Maduragoda**House No** : H 24**Name** : K.M Ariyawathi.**Address** : Kotuhena,Udaththapala  
Maduragoda**GPS Coordinate:**

E – 174650

N – 264969

**Inspected Date:**-23-07-2020

<b>(1) Identification number of house:</b>	H 24	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 24	
<b>(3) Approximate age of the house:</b>	06 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Asbestos sheet	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks & Cement block
	<b>5.2.2 Thickness :</b>	130mm
<b>5.3 Detail of the plaster:</b>	No	
<b>5.4 Detail of the windows:</b>	Window frame only	
<b>5.5 Details of floor</b>	Cemented	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



Plan view of H-24

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracked & damaged at inspection time

**MJC – Major Crack**

**C- Crack**

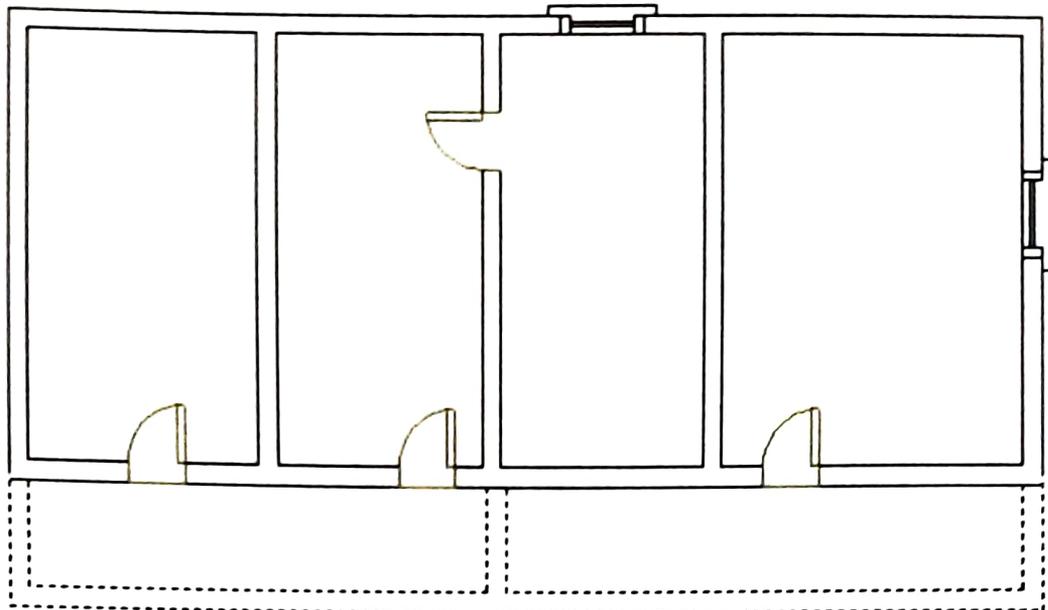
**MC – Minor crack**

**Location** : RS Mine-Maduragoda  
**House No** : H 25  
**Name** : P.M Dayawathi  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E - 174637  
 N - 264964



**Inspected Date:**-23-07-2020

<b>(1) Identification number of house:</b>	H 25	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 25	
<b>(3) Approximate age of the house:</b>	50 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Corrugated sheets	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Daub & wattle
	<b>5.2.2 Thickness :</b>	-
<b>5.3 Detail of the plaster:</b>	No	
<b>5.4 Detail of the windows:</b>	Wooden	
<b>5.5 Details of floor</b>	Cement Grouted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-25**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	The house was constructed by daub and wattle

**MJC – Major Crack**

**C- Crack**

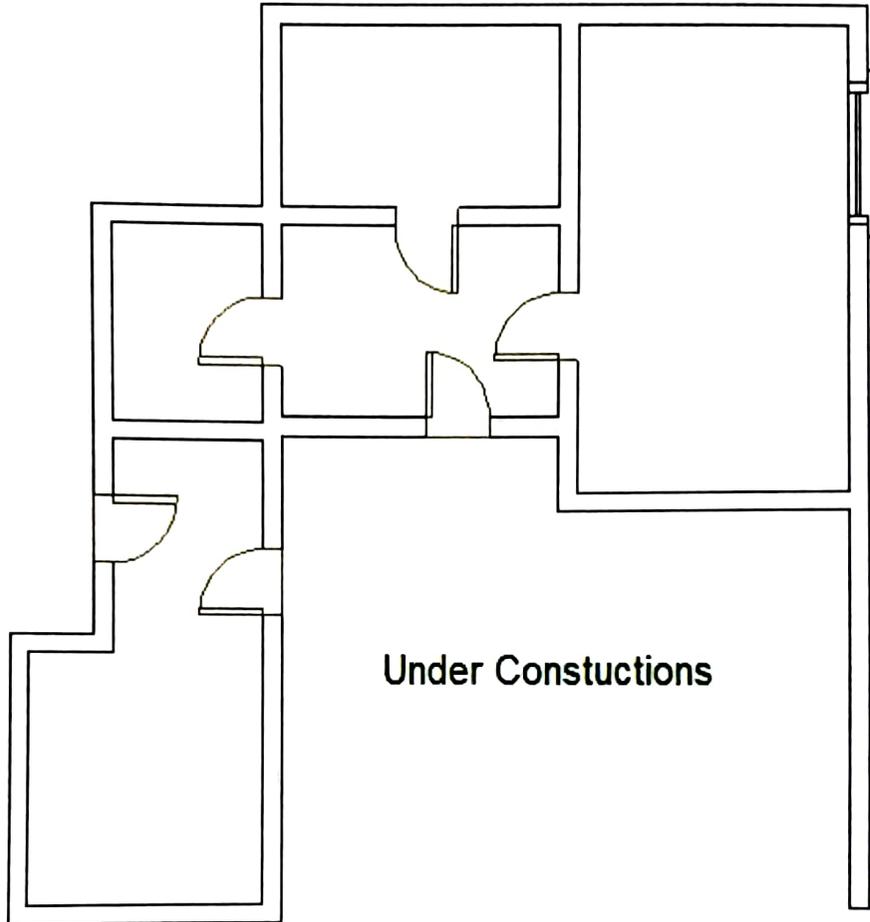
**MC – Minor crack**

**Location** : RS Mine-Maduragoda  
**House No** : H 26  
**Name** : P Pushpalal  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E – 174630  
 N – 264925

**Inspected Date:-**20-07-2020



<b>(1) Identification number of house:</b>	H 26	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 26	
<b>(3) Approximate age of the house:</b>	02 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Asbestos sheets	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Cement block
	<b>5.2.2 Thickness :</b>	-
<b>5.3 Detail of the plaster:</b>	No	
<b>5.4 Detail of the windows:</b>	Window frame only	
<b>5.5 Details of floor</b>	Concreted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-26**

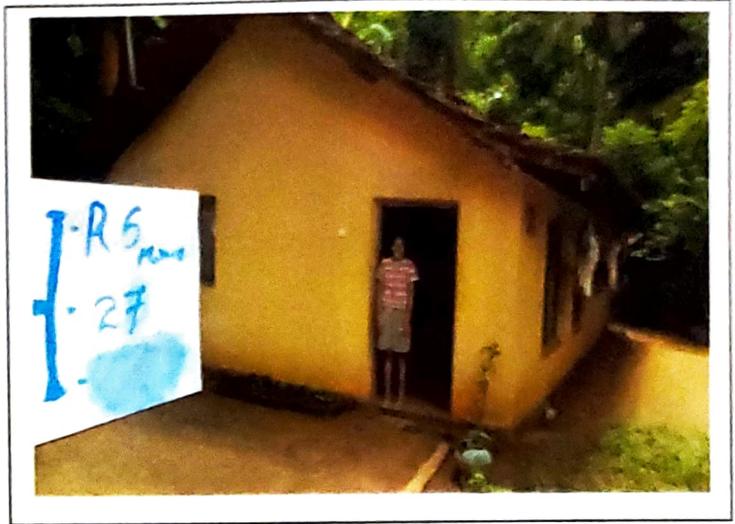
<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracked & damaged at inspection time

**MJC – Major Crack**

**C- Crack**

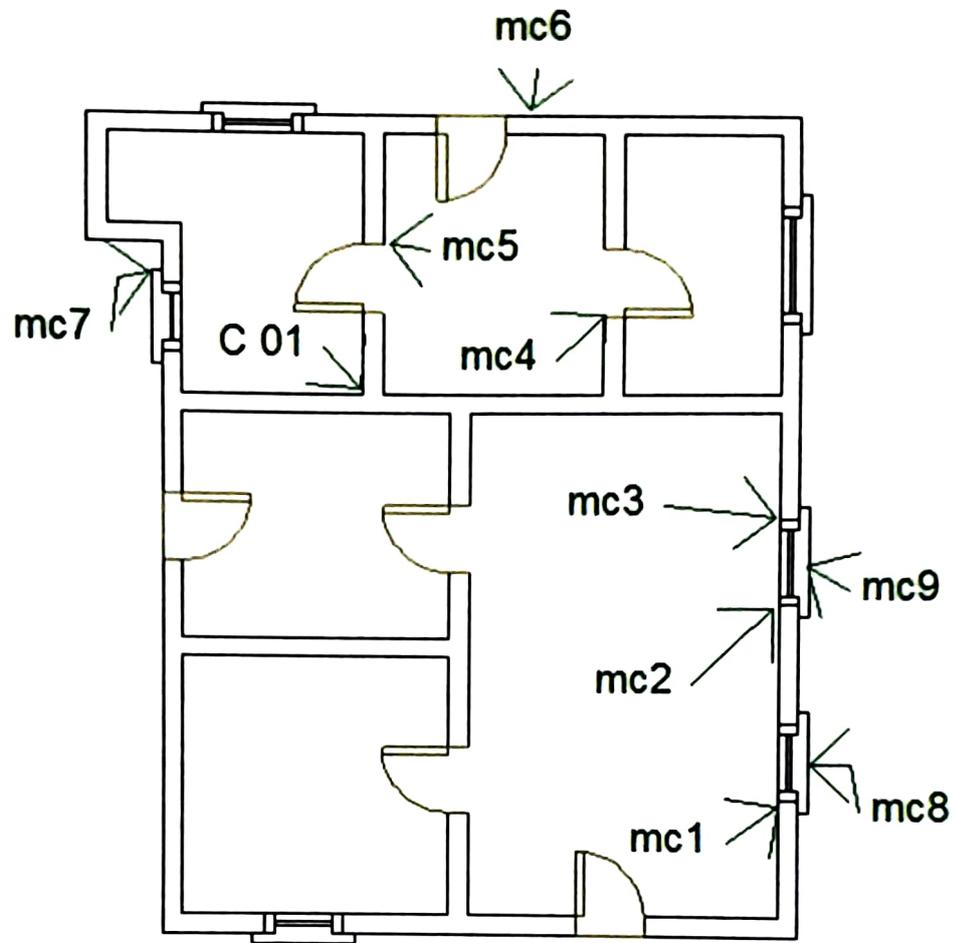
**MC – Minor crack**

**Location** :RS Mine-Maduragoda  
**House No** : H 27  
**Name** :T.G Upali  
**Address** :Udaththapala,Maduragoda  
**GPS Coordinate:**  
**E – 174510**  
**N – 264813**



**Inspected Date:-21-07-2020**

<b>(1) Identification number of house:</b>	H 27	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> -27-01	
<b>(3) Approximate age of the house:</b>	21years	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Roof tiles standard	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness:</b>	-
<b>5.3 Detail of the plaster:</b>	Both side	
<b>5.4 Detail of the windows:</b>	Wooden & Glass	
<b>5.5 Details of floor</b>	Concreted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



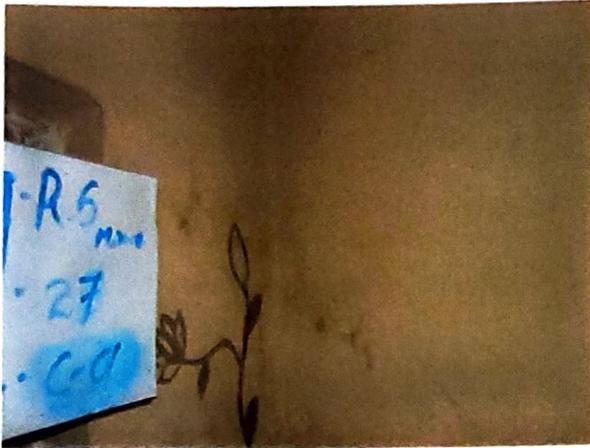
Plan view of H-27

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
MC 01	74	Minor	Horizontally from right side of the window frame
MC 02	76	Minor	Horizontally from left side of the window frame
MC 03	49	Minor	Horizontally from left side of the window frame
MC 04	37	Minor	Upward from right side of the door frame-both side
MC 05	38	Minor	Upward from right side of the door frame
MC 06	138	Minor	Downward from top to bottom on the wall
MC 07	32	Minor	Horizontally from left side of the window frame
MC 08	49	Minor	Downward from middle of the window frame
MC 09	49	Minor	Downward from middle of the window frame
C 01	144	01	Downward from top to bottom along the wall joint –both side

MJC – Major Crack

C- Crack

MC – Minor crack



C 01

**Location** :RS Mine-Maduragoda  
**House No** : H 28  
**Name** :Chamindaweerathunga  
**Address** :Udaththapala, Maduragoda  
**GPS Coordinate:**

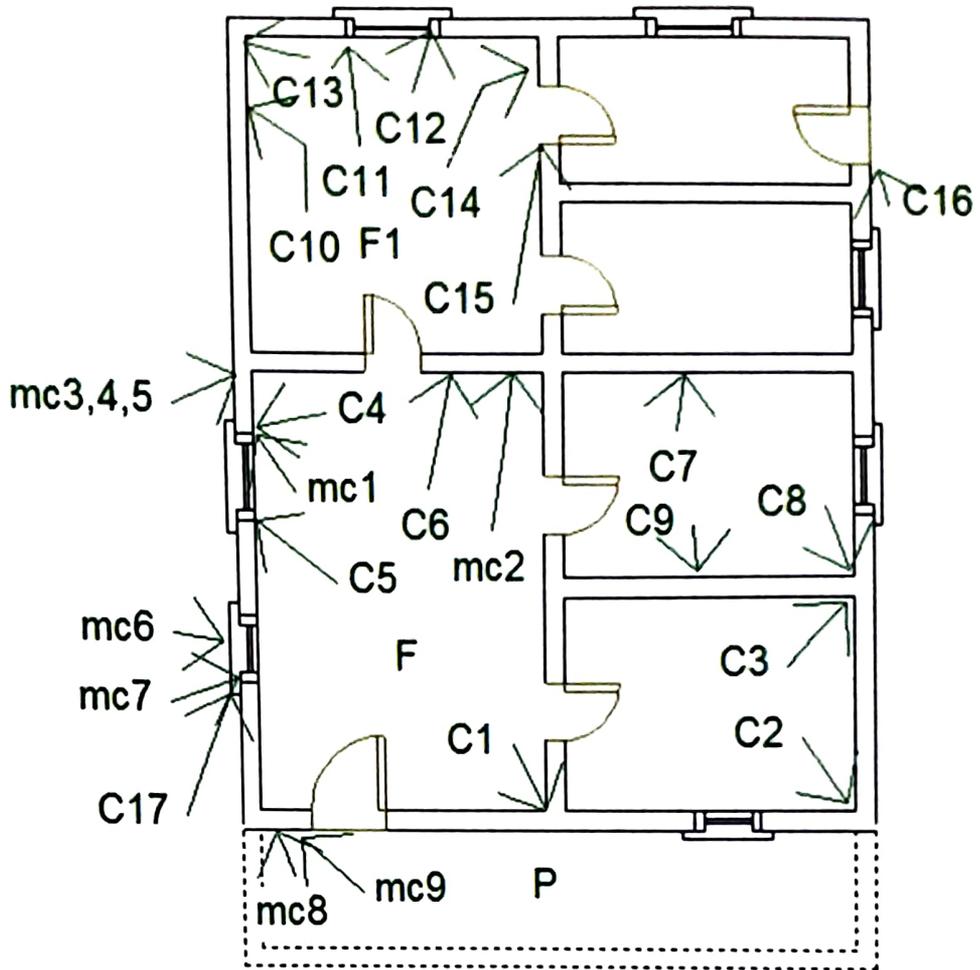
**E** – 174452

**N** – 264775



**Inspected Date:-21-07-2020**

<b>(1) Identification number of house:</b>	H 28	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> -28-23	
<b>(3) Approximate age of the house:</b>	25years	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Roof tiles standard	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness:</b>	-
<b>5.3 Detail of the plaster:</b>	Both side	
<b>5.4 Detail of the windows:</b>	Wooden & Glass	
<b>5.5 Details of floor</b>	Cement	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



Plan view of H-28

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
MC 01	23	Minor	Upward from left side of the window frame
MC 02	143	Minor	Downward from top to bottom on the wall
MC 03	25	Minor	Downward from on the wall
MC 04	60	Minor	Downward from on the wall
MC 05	59	Minor	Downward from on the wall
MC 06	28	Minor	Downward from right side of the window frame
MC 07	28	Minor	Downward from middle of the window frame
MC 08	45	Minor	Downward from on the wall
MC 09	61	Minor	Downward from on the wall
C 01	142	01	Downward from top to bottom along the wall joint –both side
C 02	109	01	Downward from top to bottom along the wall joint
C 03-I	142	01	Downward from top to bottom along the wall joint
C 03-II	43	01	Horizontally on the wall
C 04	55	01	Upward from left side of the window frame
C 05	47	01	Upward from right side of the window frame

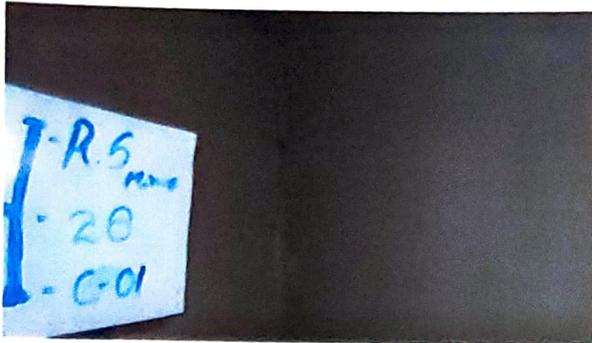
<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
C 06	201	01	Downward from top to bottom on the wall
C 07	320	01	Downward from top to bottom on the wall-bothside
C 08	218	01	Downward from top to bottom on the along the wall joint
C 09	204	01	Downward from top to bottom on the along the wall joint
C 10	206	01	Downward from top to bottom on the wall-both side
C 11	84	01	Downward from left side of the window frame-both side
C 12	84	01	Downward from right side of the window frame-both side
C 13	225	01	Downward from top to bottom on the along the wall joint
C 14	56	01	Upward from left side of the door frame –both side
C 15	67	01	Upward from right side of the door frame-both side
C 16	52	01	Upward from left side of the door frame –both side
C 17	41	01	Upward from right side of the window frame
P	490*80		Pavement has been cracked
F	165*510		Floor has been cracked
F 01	500*130		Floor has been cracked

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
A	60*110		Wall has been cracked
B	-		Pavement has been damaged
D	-		Roof tiles have been cracked

MJC – Major Crack

C- Crack

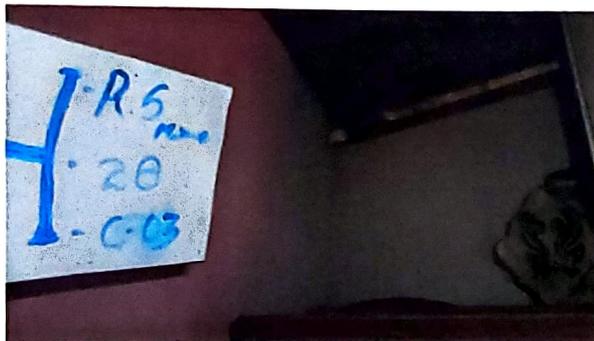
MC – Minor crack



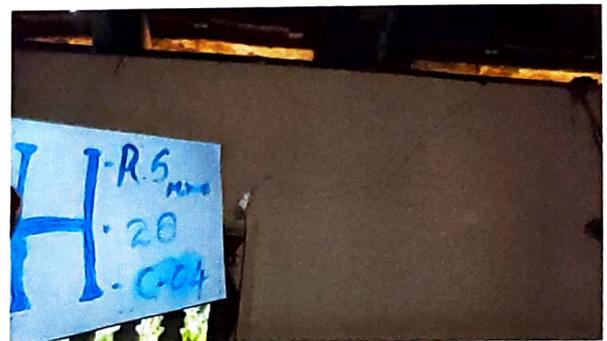
C 01



C 02



C 03



C 04



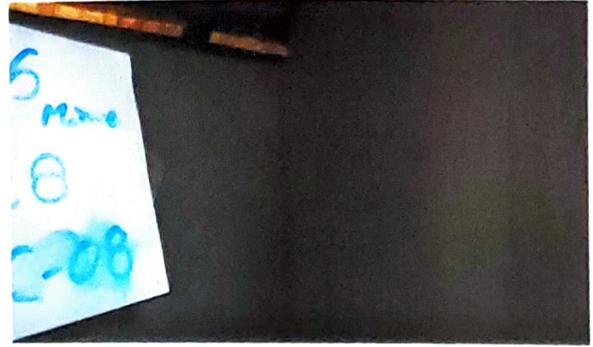
C 05



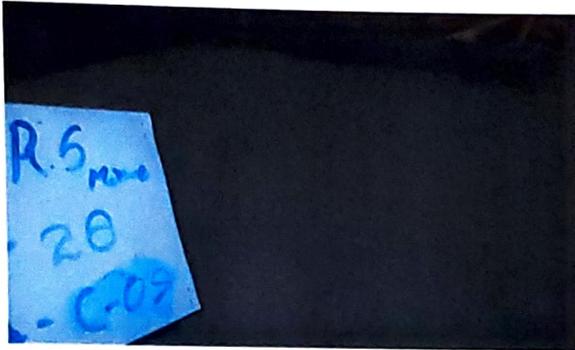
C 06



C 07



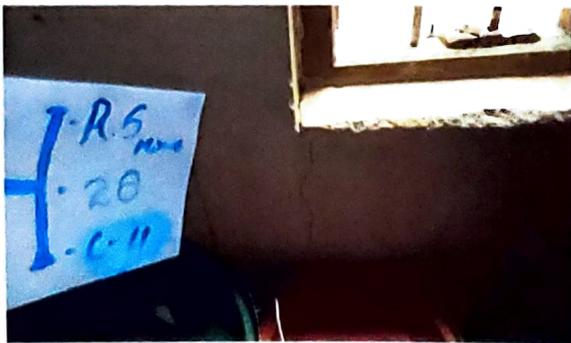
C 08



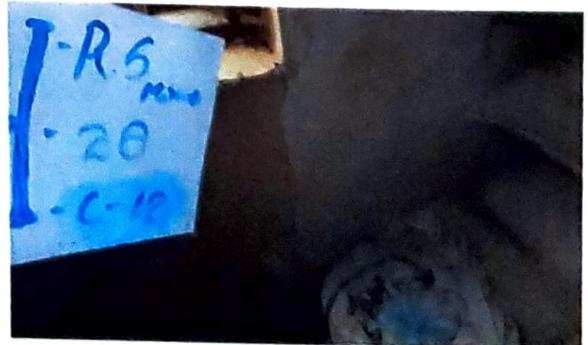
C 09



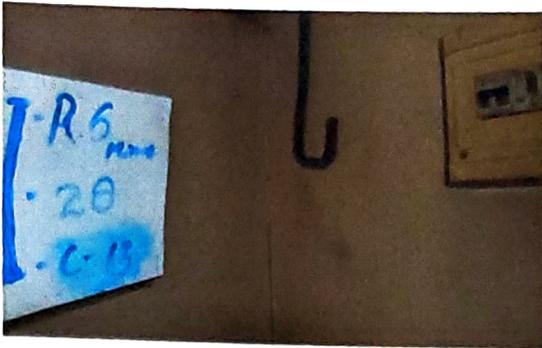
C 10



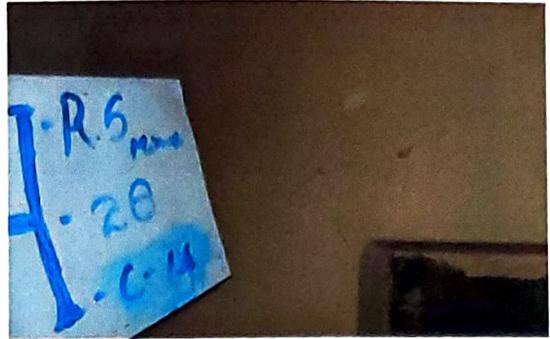
C 11



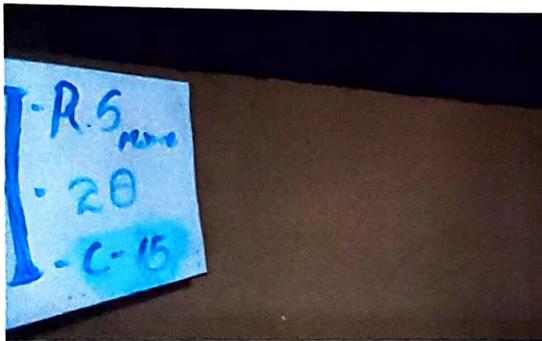
C 12



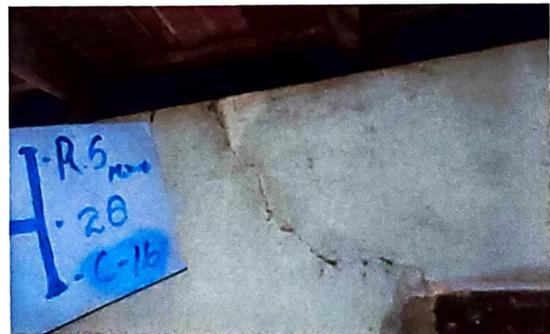
C 13



C 14



C 15



C 16



C 17



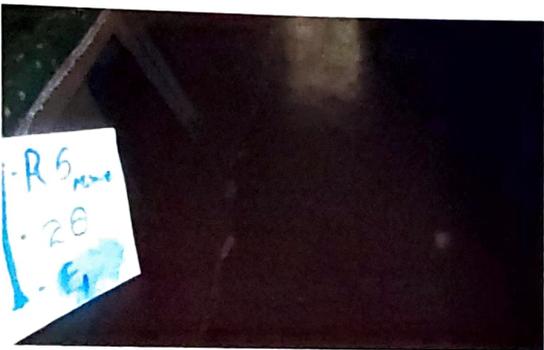
A



**B**



**P**



**F**



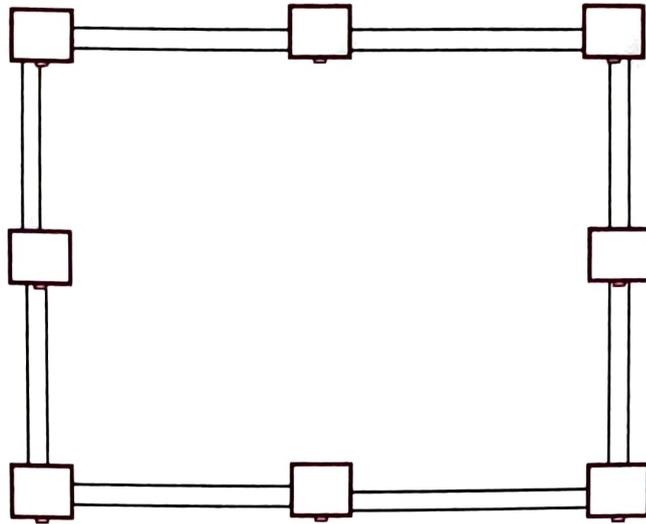
**D**

**Location** : RS Mine-Maduragoda  
**House No** : H 29  
**Name** : Shed,Queens Mine.  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E – 174606  
 N – 264970



**Inspected Date:-23-07-2020**

<b>(1) Identification number of house:</b>	H 29	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 29	
<b>(3) Approximate age of the house:</b>	04 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Corrugated sheet	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	-
	<b>5.2.2 Thickness :</b>	-
<b>5.3 Detail of the plaster:</b>	-	
<b>5.4 Detail of the windows:</b>	-	
<b>5.5 Details of floor</b>	Concreted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-29**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracked & damaged at inspection time

**MJC – Major Crack**

**C- Crack**

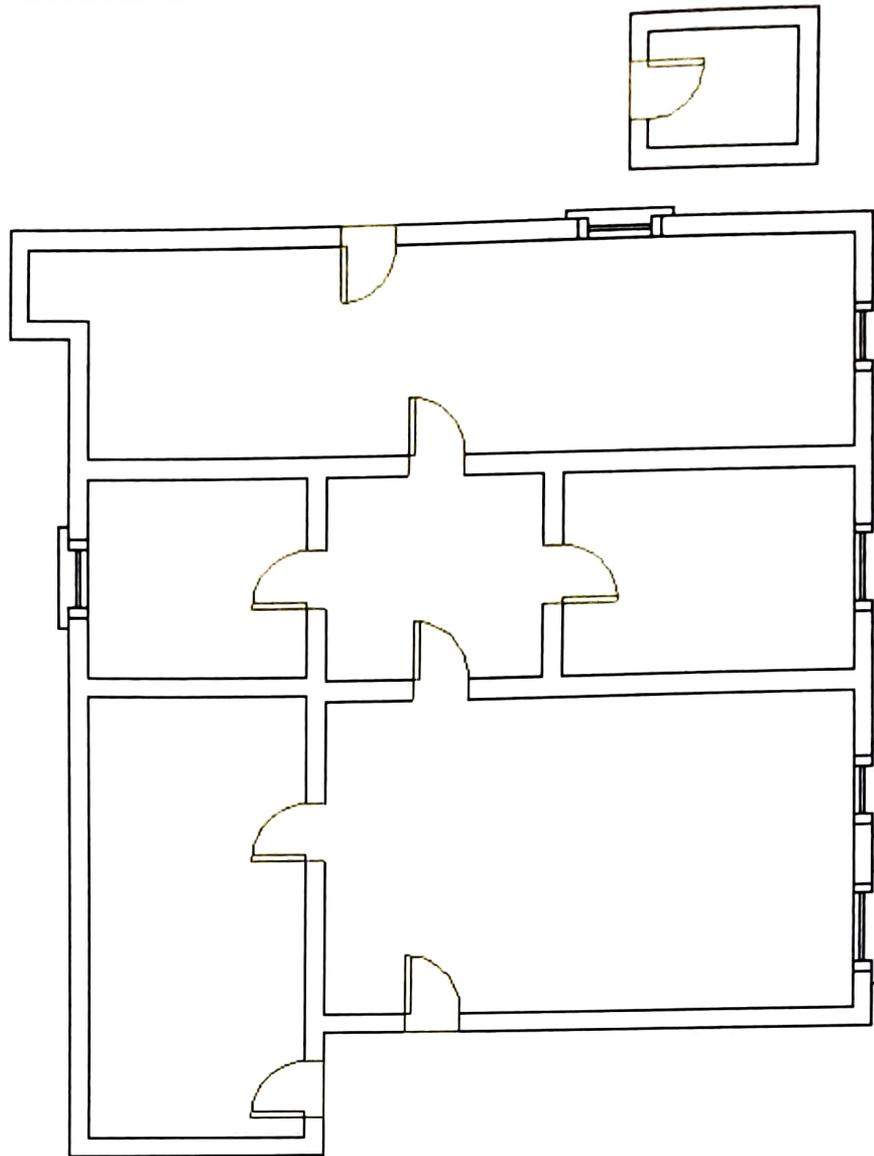
**MC – Minor crack**

**Location** : RS Mine-Maduragoda  
**House No** : H 30  
**Name** : Queens Mine House.  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E – 174617  
 N – 264985



**Inspected Date:**-23-07-2020

<b>(1) Identification number of house:</b>	H 30	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 30	
<b>(3) Approximate age of the house:</b>	20 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Asbestos sheet	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness :</b>	130mm
<b>5.3 Detail of the plaster:</b>	Both side	
<b>5.4 Detail of the windows:</b>	Wooden & Glazed	
<b>5.5 Details of floor</b>	Tiled	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-30**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracked & damaged at inspection time

**MJC – Major Crack**

**C- Crack**

**MC – Minor crack**

Location : RS Mine-Maduragoda  
 House No : H 31  
 Name : L.Y.G Nandawathi  
 Address : Udaththapala, Maduragoda  
 GPS Coordinate:

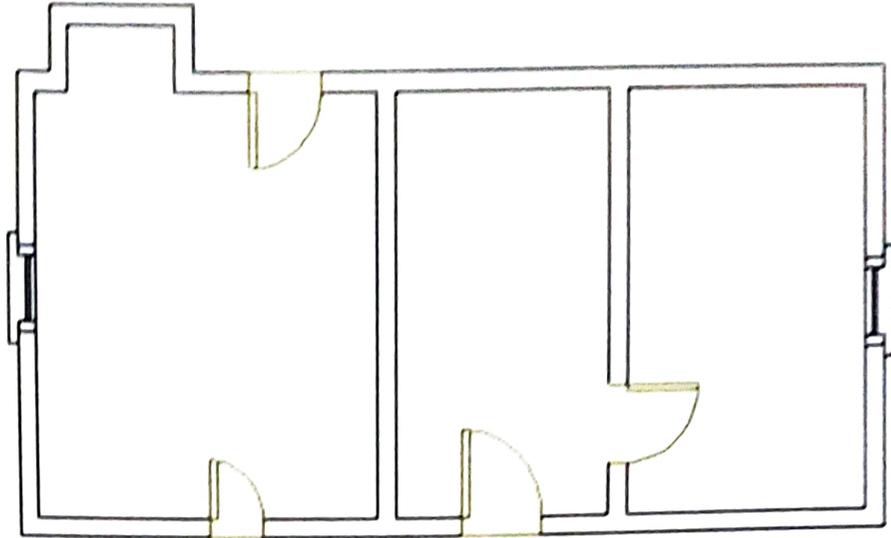
E - 174658

N - 265205

Inspected Date:-22-07-2020



(1) Identification number of house:	H 31	
(2) Photo notation:	H <sup>RS Mine</sup>	
(3) Approximate age of the house:	5 years	
(4) Details of the land in which house was built on:	Existing ground	
(5) Existing structural detail		
5.1 Detail of the roof:	Asbestos Roofing sheet	
5.2 Detail of the walls:	5.2.1 Material type:	cement
	5.2.2 Thickness:	-
5.3 Detail of the plaster:	no	
5.4 Detail of the windows:	Window frame only	
5.5 Details of floor	Cement & Concreted	
5.6 Details of foundation	Floating foundation	



**Plan view of H-31**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracks & damages

**MJC – Major Crack      C- Crack      MC – Minor crack**

**Location** : RS Mine-Maduragoda

**House No** : H 32

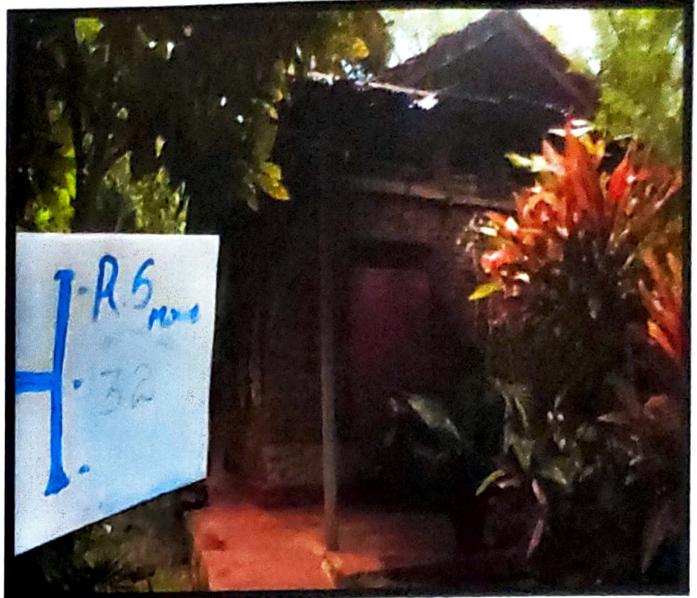
**Name** : W.A Piyadasa

**Address** : Udaththapala,  
Maduragoda

**GPS Coordinate:**

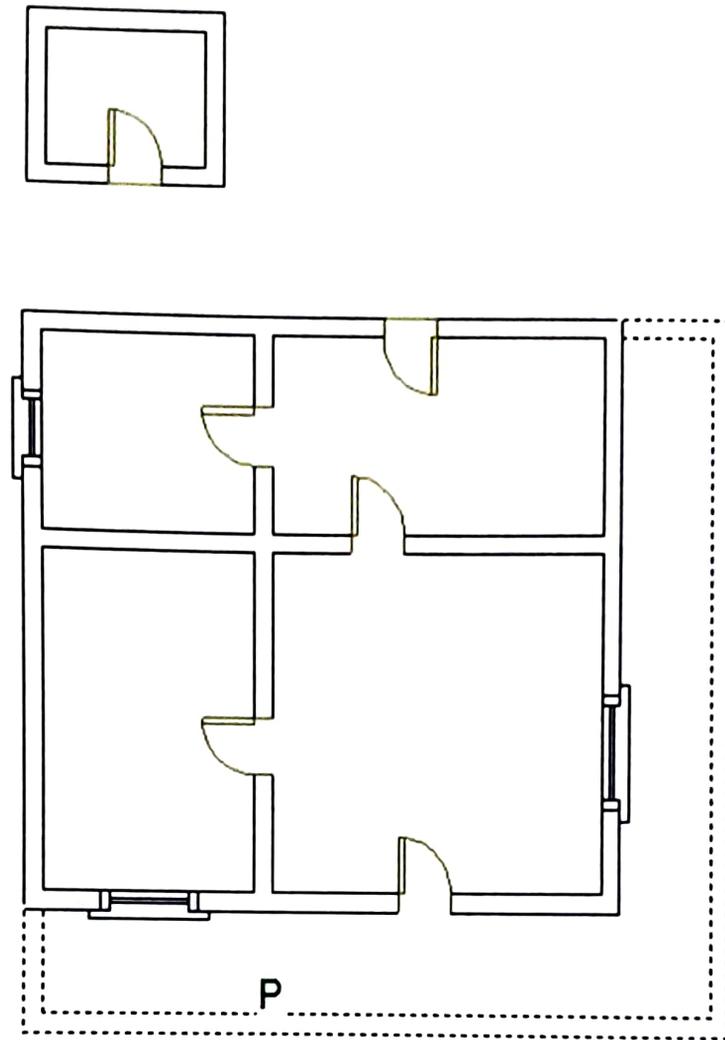
**E** – 174676

**N** – 265227



**Inspected Date:-22-07-2020**

<b>(1) Identification number of house:</b>	H 32	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> -P	
<b>(3) Approximate age of the house:</b>	20 years	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Roof tiles standard	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks
	<b>5.2.2 Thickness:</b>	-
<b>5.3 Detail of the plaster:</b>	No	
<b>5.4 Detail of the windows:</b>	Window frame only	
<b>5.5 Details of floor</b>	Cement & Concreted	
<b>5.6 Details of foundation</b>	Floating foundation	



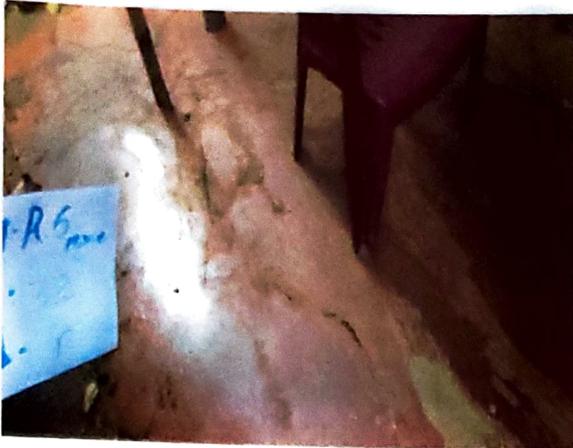
**Plan view of H-32**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
P	500cm*500cm		Pavement has been cracked

MJC – Major Crack

C- Crack

MC – Minor crack



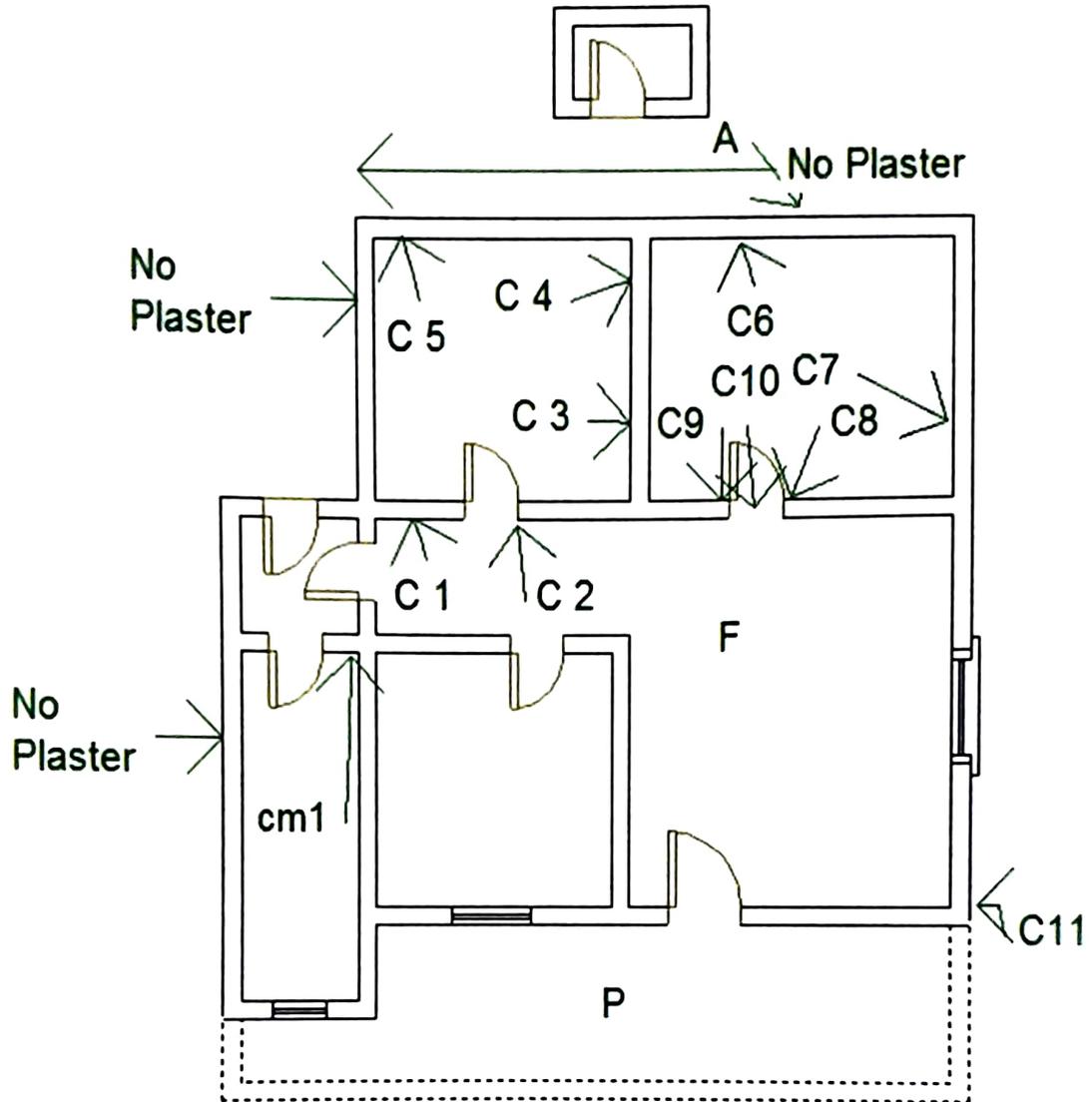
P

**Location** :RS Mine-Maduragoda  
**House No** : H 33  
**Name** :M.A.Pradeep  
**Address** :Udaththapala,Maduragoda  
**GPS Coordinate:**  
**E** – 174682  
**N** – 265100

**Inspected Date:-20-07-2020**



<b>(1) Identification number of house:</b>		H 33
<b>(2) Photo notation:</b>		H <sup>RS Mine</sup> -14
<b>(3) Approximate age of the house:</b>		35years
<b>(4) Details of the land in which house was built on:</b>		Existing ground
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Roof tiles standard& Slab	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Bricks& cement blocks
	<b>5.2.2 Thickness:</b>	-
<b>5.3 Detail of the plaster:</b>	Some part	
<b>5.4 Detail of the windows:</b>	Wooden & Glass	
<b>5.5 Details of floor</b>	Cement & Concreted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



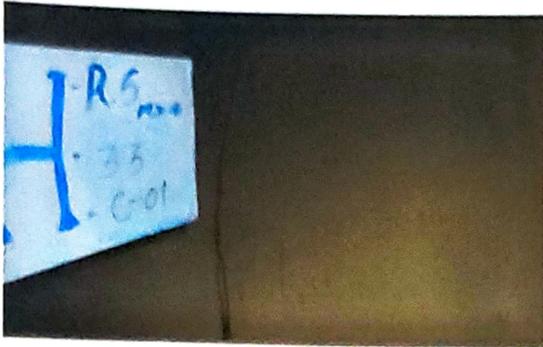
**Plan view of H-33**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
MC 01	97	Minor	Downward from along the wall joint
C 01	76	01	Downward from top to bottom on the wall
C 02	153	02	Upward from above the middle of the door frame-both side
C 03	183	03	Downward from top to bottom on the wall-both side
C 04	168	02	Downward from top to bottom on the wall-both side
C 05	137	02	Downward from top to bottom on the wall-both side
C 06	352	10	Downward from top to bottom on the wall-both side
C 07	251	08	Downward from top to bottom on the wall-both side
C 08	121	03	Upward from left side of the door frame
C 09	143	02	Upward from right side of the door frame
C 10	33	01	Upward from above the middle of the door frame
C 11	122	10	Downward from top to bottom on the wall
P	500*500		Pavement has been cracked
F	500*30		Floor has been cracked
A	300*180		Crack on the wall

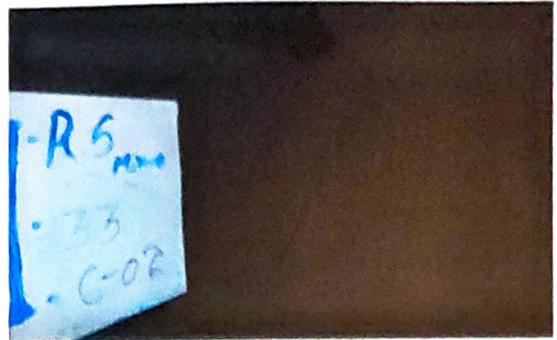
MJC – Major Crack

C- Crack

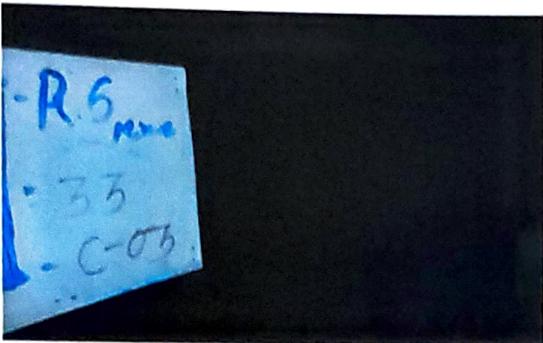
MC – Minor crack



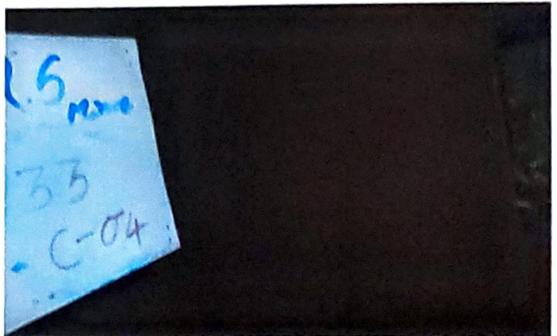
C 01



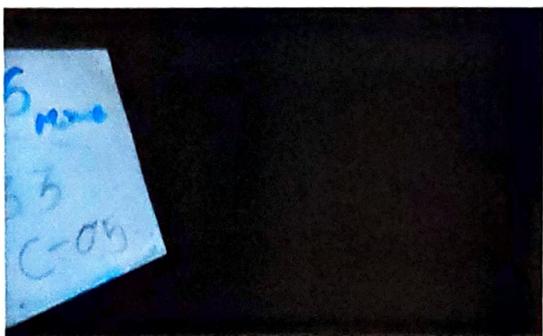
C 02



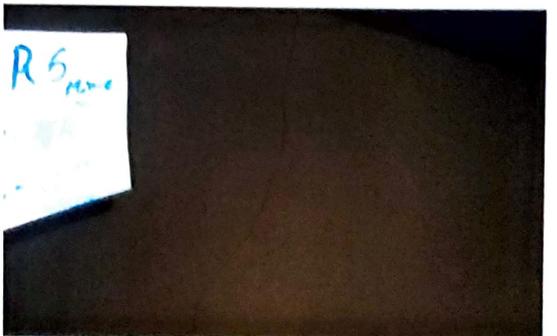
C 03



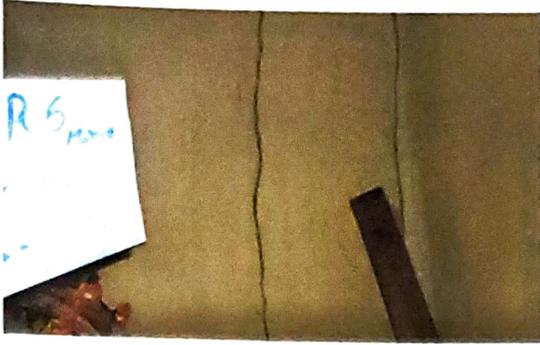
C 04



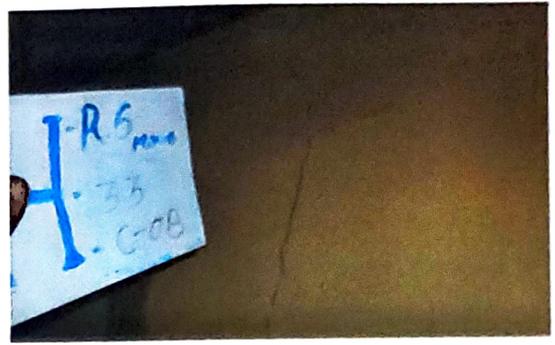
C 05



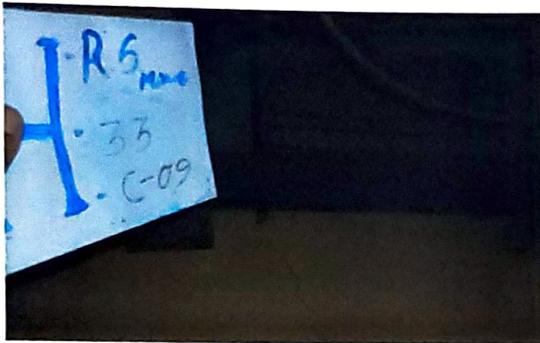
C 06



C 07



C 08



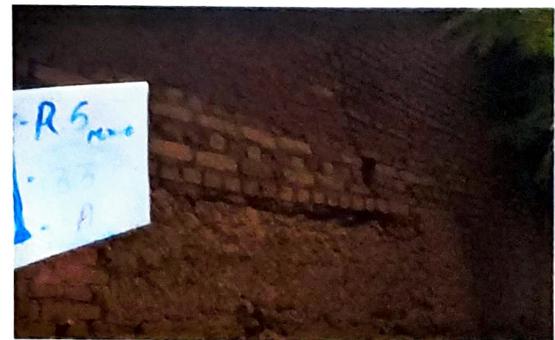
C 09



C 10



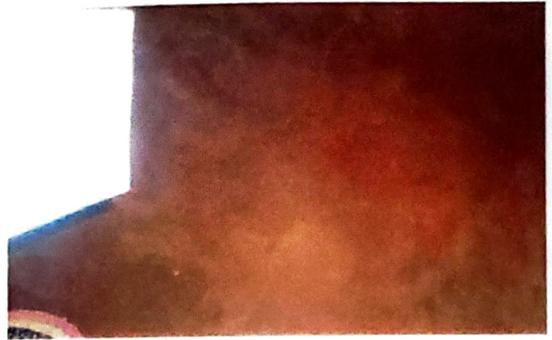
C 11



A



**P**



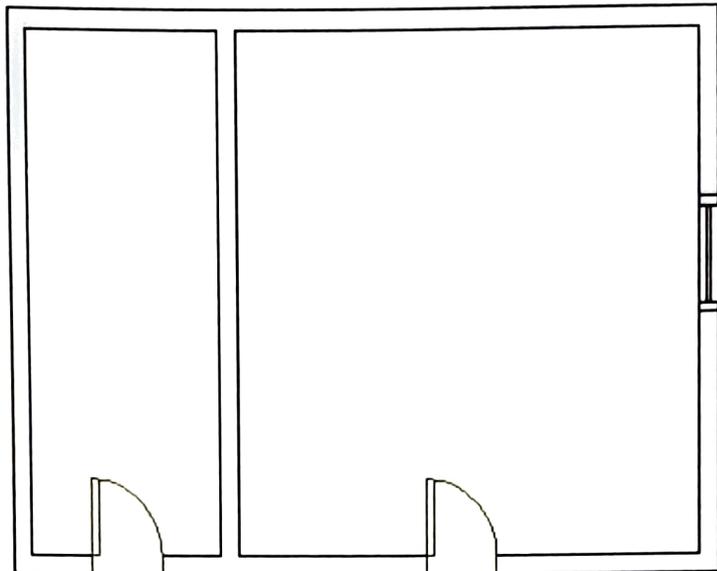
**F**

**Location** : RS Mine-Maduragoda  
**House No** : H 34  
**Name** : A Dhanapala  
**Address** : Kotuhena,Udaththapala  
 Maduragoda  
**GPS Coordinate:**  
 E – 174651  
 N – 265093



**Inspected Date:**-20-07-2020

<b>(1) Identification number of house:</b>	H 34	
<b>(2) Photo notation:</b>	H <sup>RS Mine</sup> 34	
<b>(3) Approximate age of the house:</b>	02 years.	
<b>(4) Details of the land in which house was built on:</b>	Existing ground	
<b>(5) Existing structural detail</b>		
<b>5.1 Detail of the roof:</b>	Corrugated sheets	
<b>5.2 Detail of the walls:</b>	<b>5.2.1 Material type:</b>	Cement block
	<b>5.2.2 Thickness :</b>	130mm
<b>5.3 Detail of the plaster:</b>	No	
<b>5.4 Detail of the windows:</b>	Wooden & Glass	
<b>5.5 Details of floor</b>	Concreted	
<b>5.6 Details of foundation</b>	Rubble & Masonry	



**Plan view of H-34**

<b>(6) Details of cracks at the Pre-Survey</b>			
<b>Pre-Survey</b>			<b>Remarks</b>
<b>Crack No</b>	<b>Length (cm)</b>	<b>Thickness (mm)</b>	
Note	-	-	No cracked & damaged at inspection time

MJC – Major Crack

C- Crack

MC – Minor crack

Investigated & Prepared by: -



D.A.I.A Jayasekara

Mining Engineer

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190/A, Rathnaweera Building,  
Stanley Thilakarathne Mawatha,  
Nugegoda

**ANNEX – 4.2.2.3**

**Geohydrological Report Prepared by**  
**Water Resources Board**

