

**DRAFT
ENVIRONMENT IMPACT ASSESSMENT (EIA) REPORT &
ENVIRONMENT MANAGEMENT PLAN (EMP),**

Prepared

for

M/s MUKKOM PROPERTY DEVELOPERS PVT. LTD.

Minor Mineral Mining (Building Stone Quarry) Project
for mine lease area of 8.1765 ha.
at Kumaranellor Village, Kozhikode Taluk & District, Kerala

Submitted

Shri Abdul Azeez C.K., (Managing Director)
M/s Mukkom Property Developers Pvt. Ltd.
Cheenathamkuzhiyil, Malayamma Post, NIT,
Kozhikode, Kerala-673601.

(ToR Proposal No. SIA/KL/MIN/43696/2019
File No. 1448/EC3/2019/SEIAA dt. 26-07-2023)

Studies and Documentation

by

M/s Environmental Engineers & Consultants Pvt. Ltd.

A1-198, Janak Puri, New Delhi – 110 058.

(NABET/QCI Accreditation Certificate No. NABET/EIA/2326/RA 0285 dt. 01-05-2023
valid upto 18-03-2026)

Branch Office :- Apartment No. C- 306, Kanchanjunga Apartments,
Civil Line Road, Palarivattom PO, Kochi, Ernakulam, Kerala-682025.

Name of NABL Laboratory : M/s Standard Environmental & Analytical laboratory
Ernakulam, Kerala - 683501
NABL Acc. : TC-5402
Monitoring Period : September, October, November, 2023.

Submitted To:

**Kerala State Pollution Control Board
(November, 2023)**

MUKKOM PROPERTY DEVELOPERS PVT. LTD.

CHEENATHAMKUZHIYIL HOUSE, MALAYAMMA EAST, MALAYAMMA P.O
NIT CAMPUS - 673 601, KOZHICODE
Ph: 9447609999

DECLARATION BY THE PROJECT PROPONENT

I, Abdul Azeez C.K., Managing Director M/s Mukkom Property Developers Pvt. Ltd. having correspondence address at Cheenathamkuzhiyil, Malayamma Post, NIT, Kozhikode, Kerala-673601, do hereby affirm and confirm as follows:-

1. That, we propose to take Environmental Clearance for the quarry project at Survey No. (Un survey), Kumaranellor Village, Kozhikode Taluk, Kozhikode District, Kerala for a Mine Lease (ML) area of 8.1765 ha.
2. That, the Terms of Reference (ToR) for EIA study was approved under the provisions of EIA Notification, 2006 issued under Environment Protection Act, 1986.
3. That, as per the approved Terms of Reference (ToR), Environment Impact Assessment (EIA) study was conducted during September, October & November, 2023 by M/s Environmental Engineers and Consultants Pvt. Ltd., an Accredited Consultancy Organization by MoEF&CC under NABET / QCI Scheme.
4. That, the contents of the EIA report are factual and true to the best of our knowledge and we owe the responsibility of the same.

Place : Kozhikode

SIGNATURE:



Date : 07-11-2023
Ltd,

Mr. Abdul Azeez C.K.
Managing Director
M/s Mukkom Property Developers Pvt.
Cheenathamkuzhiyil, Malayamma Post
NIT, Kozhikode, Kerala-673601.

Declaration by ACO and Experts contributing to the EIA Report

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the EIA Report for the minor mineral mining project of Mukkom Property Developers Pvt. Ltd is situated at Survey No. (Un survey), Kumaranellor Village, Kozhikode Taluk, Kozhikode District, Kerala for a Mine Lease (ML) area of 8.1765 ha.

EIA coordinator (EC): **Sector-1 (Open Cast Mining)**

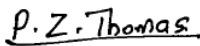

Name: **P. Z. THOMAS**


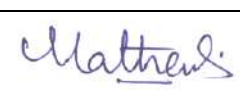

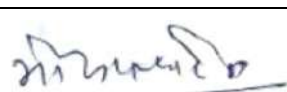
Signature and Date: P. Z. Thomas 15/11/2023

Period of involvement: **August, 2019 to Till date**

Contact information: **Head Office :- A1-198, Janak Puri, New Delhi – 110058.**
Ph. No. 011-25507190 / 25622604 &
Branch Office: C-306, Kanchanjunga Apartments,
Palarivattom PO, Civil Line Road, Kochi, Ernakulam, Kerala-682025.
Ph. No. 0484-4034320.

Functional area experts:

S. N.	Functional areas	Name of the expert/s	Involvement (period and task**)	Period of Involvement	Signature and date
1	AP*	P. Z. THOMAS	<ul style="list-style-type: none"> Field visit prior to award of work along with Jomon MC & Renoy Varghese (ToR stage) Field visit after the award of work along with FAEs. Study of site, project development & surroundings including sensitive features. Occasional supervision during base line monitoring. Identification of Impacts and Mitigation Measures related to AP, WP, SHW & LU Preparation of AP, WP, SHW & LU part in EIA/EMP report 	Aug., 2019 to Nov., 2023	 15-11-2023
2	WP*	P. Z. THOMAS			
3	SHW*	P. Z. THOMAS			
4	LU*	P. Z. THOMAS			15-11-2023
5	SE*	JOMON M. C.	<ul style="list-style-type: none"> Field visit prior to award of work along with EIA coordinator (ToR stage) Field visit to study of site, project development & surroundings with special focus on Social Economic aspects, impact identification and mitigation measures Need assessment study for CER activities. Preparation of SE part in EIA/EMP 	Aug., 2019 to Nov., 2023	 15-11-2023
					15-11-2023

			report		
6	SC*	RENOY VARGHESE	<ul style="list-style-type: none"> Field visit prior to award of work along with EIA coordinator (ToR stage) 	Aug., 2019 to Nov., 2023	
7	EB*	RENOY VARGHESE	<ul style="list-style-type: none"> Field visit to study of site, surroundings. Enumeration of the floral & faunal aspects of site & 10 km surrounding. Identification of species in IUCN, RET category with the help of secondary data. Identification of the possible impacts & preparation of mitigation measures. Preparation of SE part in EIA/EMP report 		16-11-2023
8	HG*	MATHEWS JM	<ul style="list-style-type: none"> HG, GEO, NV related site and surrounding area assessment, impacts identification and their management plan. Task related to RH aspects & preparation of Risk & Hazard Management Plan 	Nov. 2020 to Nov., 2023	
9	GEO*	MATHEWS JM			16-11-2023
10	NV*	MATHEWS JM			
11	RH*	MATHEWS JM			
12	HG*	YEDHUKRISHNA. C. U. (Team Member under Mathews JM)	<ul style="list-style-type: none"> As assistant Team Member along with Mathews J.M. in the field visit Assistance to Mr. Mathews J.M. in the field of HG, GEO related site and surrounding area assessment, impacts identification and their management plan. 	Oct., 2021 to Nov., 2023	
	GEO*				15-11-2023
13	AQ*	MOHAN A. PATIL	<ul style="list-style-type: none"> AQ related identification of impacts due to project development and their mitigation and management plan 	Aug., 2019 to Nov., 2023	
					16-11-2023

AP- Air Pollution Prevention, Monitoring and Control, WP- Water Pollution Prevention, Control and Prediction of Impacts, SHW- Solid Waste and Hazardous Waste Management, SE- Socio-Economics, EB- Ecology and Biodiversity, HG- Hydrology, Ground Water and Water Conservation, AQ - Meteorology, Air Quality Modeling and Prediction, LU- Land Use, RH- Risk Assessment & Hazard Management.

Declaration by Head of the ACO / authorized person

I, P. Z. THOMAS (MD & EC), hereby, confirm that the above mentioned experts prepared the EIA **for the minor mineral mining project of M/s Mukkom Property Developers Pvt. Ltd.** I also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this statement.

Signature : P. Z. Thomas

Name : P. Z. THOMAS

Designation : EIA Coordinator & Managing Director

Name of the EIA consultant organization: M/s Environmental Engineers & Consultants Pvt. Ltd.

NABET Certificate No. & Issue Date: NABET/QCI Accreditation Certificate No. NABET/EIA/2326/RA 0285 dt. 01-05-2023 valid upto 18-03-2026

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1.2	Copy of cluster certificate issued by the District Geologist, District Office, Mining & Geology Department, Kozhikode District vide letter dt. 18-09-2019
1.3	Copy of the resolution passed by the company in favour of authorized signatory
1.4	Copy of Survey sketch for mine lease area issued by Village Officer, Kumaranellor and counter signed by the Tahsildar Kozhikode
1.5	Copy of Demarcation certificate issued by the Village Officer, Kumaranellor
1.6	Copy of the 129 th meeting of SEIAA regarding approval of ToR
1.7	Details regarding Scope of the draft EIA study vs Compliance to the approved "Terms of Reference" (ToR)
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3.1	Protocol issued by Soil Testing Laboratory, Agricultural Department, Govt. of Kerala regarding the collection, preparation & transportation of soil
3.2 (A) to (E)	Soil sampling analysis reports
3.3	Non-Assignment certificates issued by Village Office, Kumaranellor
3.4	Sampling methodology and protocols for Water sampling
3.5	Analysis reports of water sampling reports collected from Ground water
3.6	Analysis reports of Surface water
3.7	Sampling methodology and protocols followed for Ambient Noise Level Monitoring
3.8	Ambient noise level analysis reports of all stations
3.9	Ecological Assessment Study Report
3.10	Climatological table of Kozhikode District of observatories in India of 1991-2020 issued by Office of Head, Climate Research & Services, Indian Meteorological Department
3.11	Sampling methodology followed for Ambient Air Quality monitoring
3.12	Ambient Air Quality analysis reports of all stations
4.1	Format Notice for "Placement for Suitable Posts"
4.2	Air Modeling Study report
10.1	A format of affidavit to be submitted to SEIAA, Kerala regarding the constitution of Environment Management Cell (EMC)
12.1	Copy of the accreditation certificate of ACO
12.2	Copy of the accreditation certificate of NABL accredited laboratory (M/s Standards Environmental & Analytical Laboratory, Ernakulam)
12.3	Copy of the Order regarding Court case pending at High Court of Kerala



LIST OF KEY ABBREVIATIONS

ACO	Accredited Consultancy Organization
AMSL	Above Mean Sea Level
AAQ	Ambient Air Quality
ANFO	Ammonium Nitrate Fuel Oil
BDL	Below Detected Level
Cu.m.	Cubic Meter
CPCB	Central Pollution Control Board
CFE	Consent for Establish
CER	Corporate Environment Responsibility
CTO	Consent to Operate
CCR	Certified Compliance Report
CZMP	Coastal Zone Management Plan
CRZ	Coastal Regulation Zone
CSIR	Council of Scientific & Industrial Research
CPA	Centrally Polluted Area
CHC	Community Health Centre
CEPI	Comprehensive Environmental Pollution Index
DEIAA	District Environment Impact Assessment Authority
DMG	Department of Mining & Geology
DGMS	Director General of Mines Safety
DEM	Digital Elevation Model
DIC	District Industries Centre
DMP	Disaster Management Plan
EIA	Environment Impact Assessment
EMP	Environment Management Plan
EAC	Expert Appraisal Committee
EC	Environmental Clearance
EECPL	Environmental Engineers & Consultants Pvt. Ltd.
EMS	Environment Management System
EMC	Environment Management Cell
ESZ	Ecological Sensitive Zone
EC	EIA Coordinator
ESA	Ecological Sensitive Area
KFRI	Kerala Forest Research Institute
FAE	Functional Area Expert
GIS	Geographic Information System
GDP	Gross Domestic Product
GST	Goods Service Tax
HT line	High Tension Line
HLWG	High Level Working Group
IUCN	International Union for Conservation of Nature
IMD	Indian Meteorological Department



IRO	Integrated Regional Office
KLD	Kilo Liter per Day
KSPCB	Kerala State Pollution Control Board
LOI	Letter of Intent
LT line	Low Tension Line
LIDAR	Light Detection and Ranging
LRIS	Land Resource Information System
LSG	Local Self Government
ML area	Mine Lease area
MT	Metric Ton
MTA	Metric Ton per Annum
MoEF&CC	Ministry of Environment, Forest & Climate Change
MCD	Maximum Charge per Delay
MoU	Memorandum of Understanding
MSL	Mean Sea Level
NABL	National Accreditation Board for Laboratory
NABET	National Accreditation Board for Education & Training
NBWL	National Board for Wild Life
NTLD	Noise Trunk Line Delays
NONEL	Non-Electrical
OB	Over Burden
O.M.	Office Memorandum
PP	Project Proponent
PPV	Permissible Peak Particle
PPE	Personnel Protection Equipments
PUC	Pollution Under Control
QCI	Quality Council of India
R & R	Rehabilitation & Re-settlement
ROM	Run of Mine
RGB	red, green, and blue
RCC	Reinforced Concrete Cement
SEIAA	State Environment Impact Assessment Authority
SEAC	State Expert Appraisal Committee
SSL	Soil Sampling Location
SDMA	State Disaster Management Authority
SPA	Severally Pollution Area
TOR	Terms of Reference
WLC	Wild Life Clearance
WLS	Wild Life Sanctuary



CHAPTER – 1

INTRODUCTION

1.0 INTRODUCTION

1.1 Purpose of the report

M/s Mukkom Property Developers Pvt. Ltd. (Project Proponent-PP) proposes to set up a new building stone mining (quarry) project at Survey No. (Un survey), Kumaranellor Village, Karassery Grama Panchayat, Kozhikode Taluk, Kozhikode District, Kerala for a Mine Lease (ML) area of 8.1765 ha. with annual production of 3,00,000 MT (max.). Since the proposed ML area is 8.1765 ha. which is more than 5 hectares and is categorized as Category 'B1' and "Mining of Minerals" is classified as Item No. 1(a) in *SCHEDULE* of EIA Notification, 2006. Under the provisions of this Notification, mining of minerals with area more than 5 hectares are required to conduct EIA study, prepare EIA/EMP Report and to conduct public hearing before obtaining prior Environmental Clearance and which is a mandatory requirement as per the provisions of EIA Notification, 2006.

The proposed quarry is accorded with Letter of Intent (LOI) from Directorate of Mining & Geology, Thiruvananthapuram, Govt. of Kerala vide letter no. 6767/M3/2019 dt. 25-07-2019. The copy of the LOI is attached at **Annexure No. 1.1**. A cluster certificate was issued by the District Geologist, District Office, Mining & Geology Department, Kozhikode District vide letter dt. 18-09-2019 stating that there is no quarry within 500 meters from the periphery of proposed ML area. The copy of the cluster certificate is attached at **Annexure No. 1.2**.

An application was submitted at State Environment Impact Assessment Authority (SEIAA), Kerala for approval of Terms of Reference (ToR) for the conduction of EIA study. With a view to assess the environmental impacts due to the mining activities and to suggest the mitigation measures as per the approved ToR granted, the PP has engaged the services of M/s Environmental Engineers & Consultants Pvt. Ltd., New Delhi (an MoEF & CC Accredited Consultancy Organization (ACO) under QCI / NABET Scheme).

1.2 Identification of project & project proponent.

1.2.1 Identification of project.

The project proponent has identified the mine site considering the mineral reserve (deposit of building stone) in the area.



1.2.2 Identification of project proponent.

Table 1.1 - Identification of project proponent

Name of Authorized Signatory & Designation	Shri Abdul Azeez C.K., (Managing Director)
Correspondence Address	M/s Mukkom Property Developers Pvt. Ltd. Cheenathamkuzhiyil, Malayamma Post, NIT, Kozhikode, Kerala-673601.
Contact No.	Mob. No. 09745178677
E-mail ID	mukkamproperty@gmail.com

The copy of the resolution passed by the company is attached at **Annexure No. 1.3**.

M/s Mukkom Property Developers Pvt. Ltd. is a Private limited company with its registered office at Ernakulam, Kerala and the company is registered with Ministry of Corporate Affairs, Govt. of India, and the Certificate of Incorporation is issued on 24-03-2015. It is involved in Real estate activities with own or leased property. This class includes buying, selling, renting and operating of self-owned or leased real estate such as apartment building and dwellings, non-residential buildings, developing and subdividing real estate into lots etc. Also included are development and sale of land and cemetery lots, operating of apartment hotels and residential mobile home sites.

1.3 Brief description of nature, size, location of project & its importance to country, region.

1.3.1 Nature and Size of the project

The proposal is for mining of building stone through open cast mechanized method with ML area of 8.1765 ha. and with annual production of 3,00,000 MT (max.).

1.3.2 Location of the project

The location details of the project is given below :-

Table 1.2 – Immediate surrounding details of the project site

Direction	Existing surrounding features
North	Partially Own property & Others property with Rubber plantation
South	Partially Own property with Rubber plantation & Forest land
East	Partially Own property & Others property with Rubber plantation
West	Own property with Rubber plantation



Location details of the project is given in Table 1.3 below.

Table 1.3 - Location details of the project

Particulars	Details	
Geographical Location	Latitude (N)	11°18'34.49"N to 11°18'44.15"N
	Longitude (E)	76°04'08.12"E to 76°04'21.57"E
Local name of project area	<i>Thekkinkkad</i>	
Site Topo sheet No.	C43E03	
Name of Village	Kumaranellor	
Name of Panchayat	<i>Karassery</i> Grama Panchayat	
Nearest Town	Mukkom	
Name of Taluk	Kozhikode	
Name of District	Kozhikode	
Name of State	Kerala	

The survey sketch for mine lease area issued by Village Officer, Kumaranellor and counter signed by the Tahsildar Kozhikode is enclosed at **Annexure No. 1.4**. The demarcation certificate issued by the Village Officer, Kumaranellor is attached at **Annexure No. 1.5**.

The key map showing the location of the proposed mine lease area is provided at **Figure 1.1**.



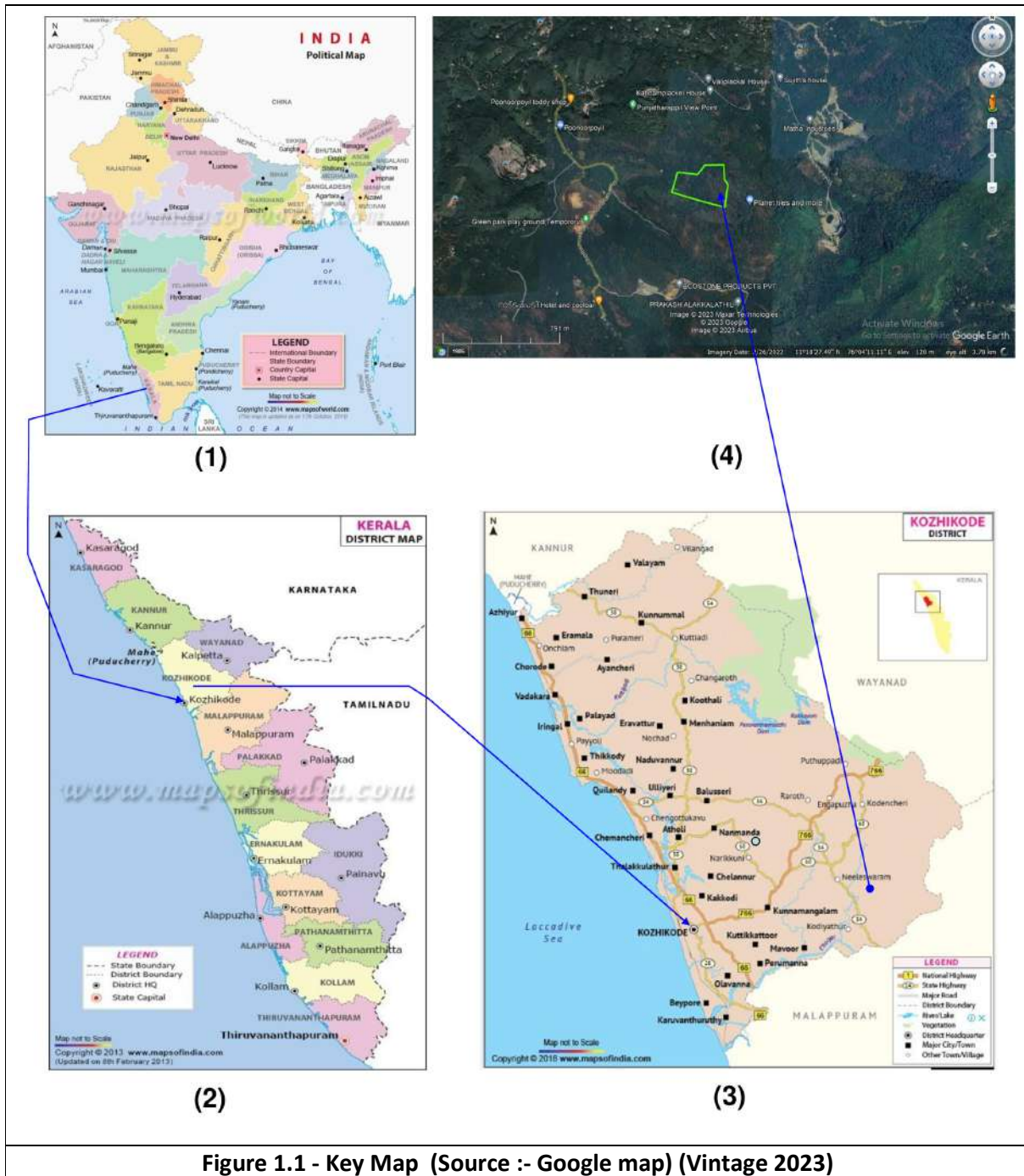


Figure 1.1 - Key Map (Source :- Google map) (Vintage 2023)



1.3.3 Importance of the project to the country and to the region.

The mining projects for building stone and its important to the region and the country is discussed in this portion of the report. The major demand of building stone is due to its high compressive strength and durability (among the hardest, dimensional & structural stones), it can effectively withstand the vagaries of nature. The mineral-rich colors and the hardness & density, makes it useful for many applications. The mining project will fulfill its end uses in construction of buildings and construction of roads etc. It is also known as the maintenance-free stone. The main market for the mineral is within Karassery Grama Panchayat and also in the surrounding Panchayats in Kozhikode District and Malappuram District.

Mining and associated activities bring about gains in Gross Domestic Product (GDP). The project proponent (PP) need to pay royalty to the Department of Mining & Geology, Govt. of Kerala for every unit of the mineral produced from the mine. Direct and indirect taxes will also be paid by the PP to the Local Self Government, State Government and to the Central Government. These are the sources of revenue for the Government. The public revenue will be utilized by Government for development of various infrastructural facilities for the public in the field of health, education, roads and social welfare etc. The proposed project will create direct employment opportunities for about 50 persons and indirect employment opportunities for about 100 persons.

1.4 Scope of the study – details of regulatory scoping carried out (as per Terms of Reference)

Table 1.4 - Details of ToR application & its approval

Particulars	Details
Date of Submission of draft ToR through online in <i>PARIVESH</i> Portal	26-09-2019
Proposal Number	SIA/KL/MIN/43696/2019
File Number	1448/EC3/2019/SEIAA
Recommendation by SEAC	142 nd SEAC meeting held on 11 th – 12 th May, 2023
Approval of ToR by the Authority (SEIAA)	Appraisal of project for approval of ToR in 129 th meeting of SEIAA held on 26 th & 27 th July, and the decision is quoted below :-



	<p><i>“The Authority decided to approve the Standard Terms of Reference with the following additional aspects for EIA Study as recommended by SEAC :-</i></p> <ol style="list-style-type: none"> <i>1. Vibration studies to evaluate the zone of influence and impact of blasting on the neighbourhood as suggested in para (e) of OM No Z -11013/57/2014-IA.II (M) dated 29-10-2014 of MOEF&CC.</i> <i>2. Study the Impact on Forest and Wild Life.</i> <i>3. Study the impact on the hydrology of the region by considering the local rainfall, and seasonal and ground water variations and also propose mitigative / management measures</i> <i>4. The natural stream which receives the drainage from the project area should be assessed at upstream and downstream regions to maintain its ecological functions”.</i> <p>The copy of the 129th meeting of SEIAA is attached at <u>Annexure No. 1.6.</u></p>
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The details regarding Scope of the draft EIA study vs Compliance to the approved "Terms of Reference" (ToR) is provided as **Annexure No. 1.7.** The draft EIA report is prepared taking into consideration all the aspects specified in the approved ToR (both standard ToR & specific ToR directed by SEAC/SEIAA, Kerala).



CHAPTER – 2

PROJECT DESCRIPTION

2.0 PROJECT DESCRIPTION

This Chapter of the EIA Report deals with the description of the project.

2.1 Condensed Description of those aspects (based on project feasibility study) likely to cause environmental effects. The details provided below is to give clear picture of the following aspects:-

2.1.1 Type of Project:

The project is a quarry project with annual production of 3,00,000 MT (max.) (@300 working days).

2.1.2 Need for the project

The end products from the building stone mining project is rubble and which are directly used for infrastructure work or further, the rubble is sent to crusher to produce coarse aggregates, fine aggregates and sand. These materials are extensively used in building construction projects and in infrastructure developmental projects. It is observed that the quantity of sand required for construction of every square meter (sq m) of built-up area of a building is 1.35 cu.m. (1.89 MT) and the coarse & fine aggregates is about 1.55 cu.m. (2.17 MT).

A detailed field study was conducted in the project vicinity for determining the need of the above mentioned building materials.

Requirement of building materials for construction

The requirement of materials (M-sand and aggregates) for building construction was calculated based on the Building Permits/lease issued for building construction in the Local Self Governments in the study area for the last three years and the details of the local body are provided below:-

**Table 2.1 - Name of Local Self Government (Panchayats)
in the Study area (within 10 km from the proposal)**

S.N.	Local Self Government (LSG)	Name of village
1	Karassery (Full)	Kakkad, Kumaranellur & Kodyathoor
2	Thiruvambadi (Major)	Thiruvambadi
3	Koodaranhi (Major)	Koodaranhi
4	Chungathara (Small) Malappuram	Erumamunda, Chungathara
5	Chaliyar (Small) Malappuram	Akambadam, Kurumbalangodu, Pullipadam
6	Mampad (Small) Malappuram	Mampad, Pullippadam, Wandoor.



7	Urangattiri (Major) Malappuram	Urangattiri,Vettilappara
8	Edavanna (Small) Malappuram	Edavanna,Perakamanna
9	Kavanuur (Small) Malappuram	Kavanur
10	Areecode (Part) Malappuram	Areecode
11	Cheekode (Part) Malappuram	Cheekode, Muthuvallor
12	Keezhuparamba (Full) Malappuram	Keezhuparamba
13	Vazhakkad (Part) Malappuram	Vazhakkad
14	Kodiyathur (Full)	Kodiyathur&Kakkad
15	Mavoor (Small)	Mavoor
16	Chathamangalam (Part)	Poolakkode, Chathamangalam
17	Mukkom (Major)	Mukkom
18	Kodanchery (Small)	Koodathai, Kodenchery, Nellipoyil

Conclusion

From the study it is observed that, only in the building construction sector alone, the consumption of building materials (sand & aggregates) in the vicinity of the project for the last few years is much more than the materials already available locally. Further, there is pattern of annual increment of about 10 to 20%. Taking into consideration other activities like road construction, road maintenance etc., and the increase in demand in every year (@10 to 20%), there is a heavy shortage of coarse aggregates, fine aggregates and M-sand in the study area and therefore the need of the project is justified.

The rubble from the proposed mine will be sent to open market and to the following stone crusher units.

Sr. No.	Name & Location of crusher	Distance from the proposed site
1.	M/s Pattaniyil Sands & Stone Products Pvt. Ltd., Venappara Post, Omassery	8 km
2.	M/s Super Sands, Maranchatty, Koompara Post, Mukkam	3 km
3.	KV Blue Metals, Pattoth Kumaranallor Post, Koodaranji	5 km



The aggregates will be used to Calicut Expressway Private Limited for construction of proposed six lining of existing Kozhikkode Bypass (Vengalam junction to Ramanattukara Junction) as part of infrastructure works.

However, the local requirements of the people in the vicinity will be given the priority. The rubble is directly used for various infrastructure works and further the rubble can be converted to produce various sizes of coarse, fine aggregates and sand which are used for building construction, road works and other infrastructure works. About 10% of the mined out mineral quantity is lost as waste in the mine site itself. 50% of the rubble would be converted to sand, 5% of the rubble would be converted to 40 mm coarse aggregates, 15% of the rubble would be converted to 20 mm coarse aggregates, 10% of the rubble would be converted to 12 mm coarse aggregates, 10% of the rubble would be converted to 6 mm coarse aggregates.

Loose boulders in the ML area

There are loose boulders of various sizes located in the core area (19 nos.), within 7.5 m. buffer (2 no.) and in the immediate vicinity (20 nos.) of the ML area within 75 m.

Vegetation in the ML area.

There are about 1,800 trees existing in the ML area. Presently, most of the trees (about 90%) covered with Rubber Plantation. There is a small old abandoned quarry pit located near to BP11 & BP12. Also, there is a storm water drain existing near to the ML area in west direction (near BP1).

Cluster quarry

As explained earlier, the current proposal is for mine lease area of 8.1765 ha. and there is no working quarry located within 500 m. from the periphery of the proposed ML area and hence, no cluster situation.



2.1.3 Location (Map showing general location, specific location, project boundary and project site layout)

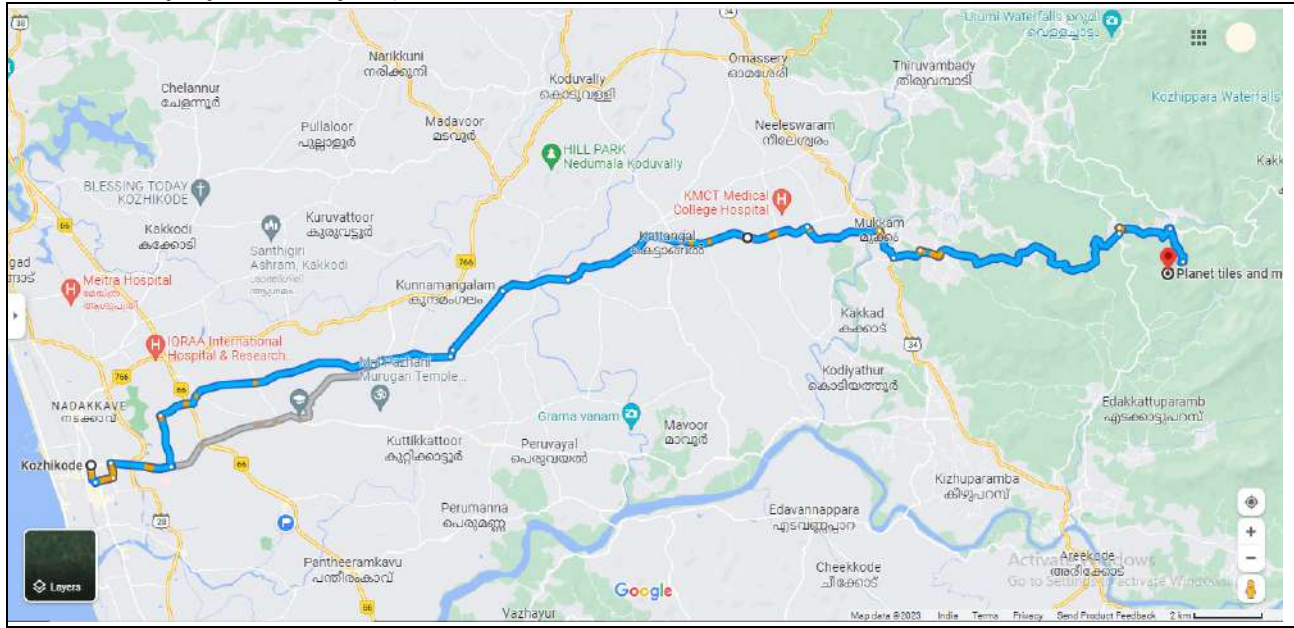


Figure 2.1 - Route map from Kozhikode to proposed ML area (Source : Google Earth) (Vintage : October, 2023)

Inference :

The project site is located at about 42 km from Kozhikode district (Road distance) and can be covered in about 1.30 minutes.

The proposed land for the mine lease area is private land (8.1765 ha.). Satellite map of the project site superimposed with project boundary is given in Figure 2.2. The satellite map showing the important environmental features within 10 kilometers from the boundary of the proposed mine lease area is given in Figure 2.3. The Toposheet of the study area is given in Figure 2.4. The Geo-tagged photographs of the Mine Lease area taken during the field visit of EC & FAE is provided at Plate 2.1 (A) to Plate 2.1(H).



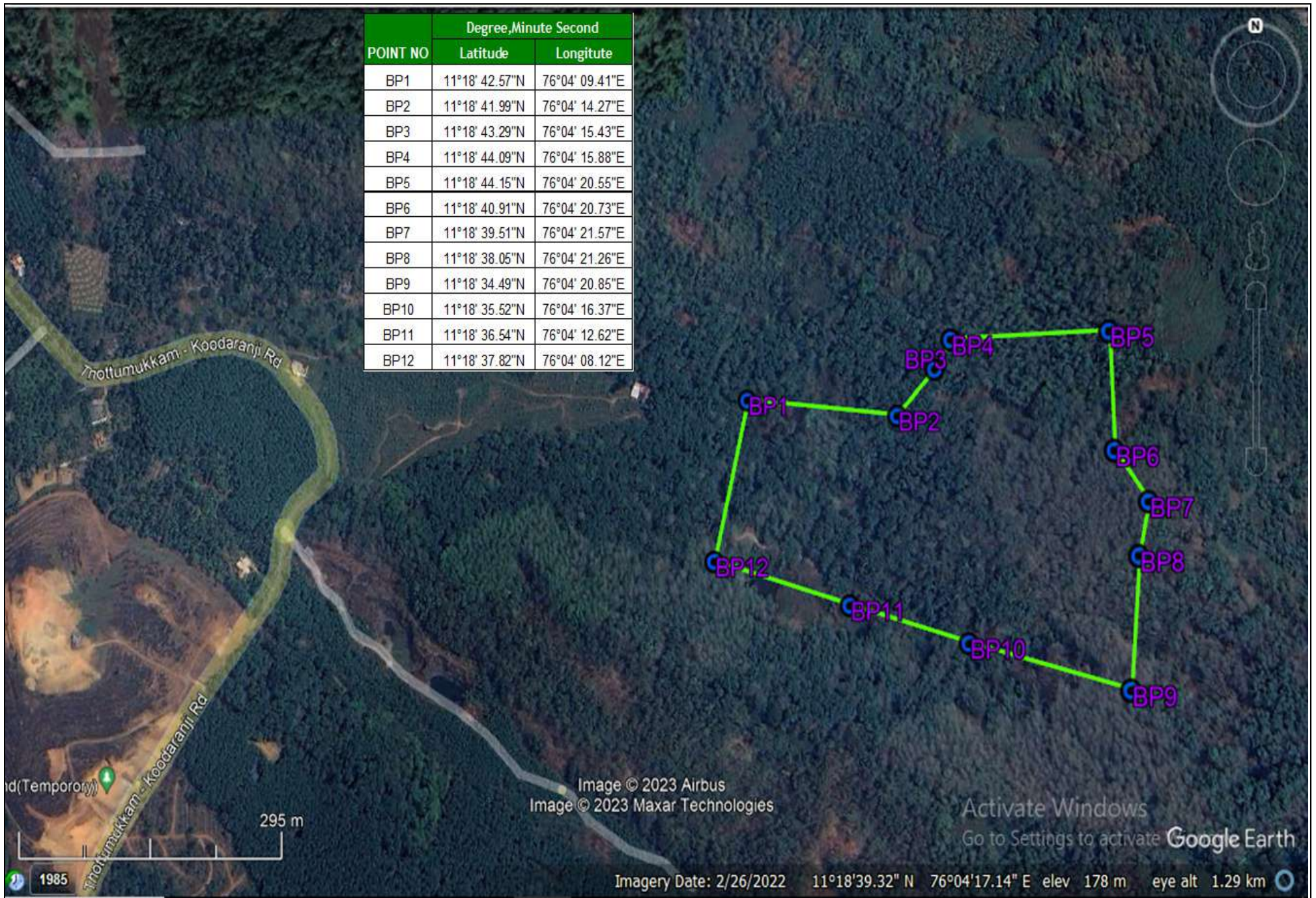
Site History

Details of ownership of the project site as per the survey sketch is given below :-

Name of property owner	Total area owned by the owners (in ha)	Applied area (in ha)
M/s Mukkom Property Developers Pvt. Ltd.	1.8137	1.7409
M/s Mukkom Property Developers Pvt. Ltd.	1.2253	1.2253
M/s Mukkom Property Developers Pvt. Ltd.	1.8137	1.4218
M/s Mukkom Property Developers Pvt. Ltd.	0.4151	0.2979
C.K. Abdul Azeez	1.2091	1.1146
C.K. Abdul Azeez	1.2091	1.2091
C.K. Abdul Azeez	1.2091	1.1669
Total	8.8951	8.1765

Part of the land is owned by Shri C.K. Abdul Azeez and Consent (“Sammathapatram”) is given to M/s Mukkom Property Developers Pvt. Ltd. for quarrying activities. The land owners purchased the land from the previous owners during 2015 - 2017. The copy of the “Sammathapatram” is attached at **Annexure No. 2.1**. The Possession Certificates are obtained from the Village Office, Kumaranellor and attached at **Annexure No. 2.2**. The project site and its surroundings are with rubber plantation for the last several decades. The overall land owned by the project proponent and the sister concerns of the project proponent is about 25 hectares.





LEGEND	
	Lease boundary line
	Boundary Pillars

Figure 2.2 : Satellite image of Site superimposed with the project boundary showing the present condition of the site (Source : Google earth) (Vintage : February, 2022)

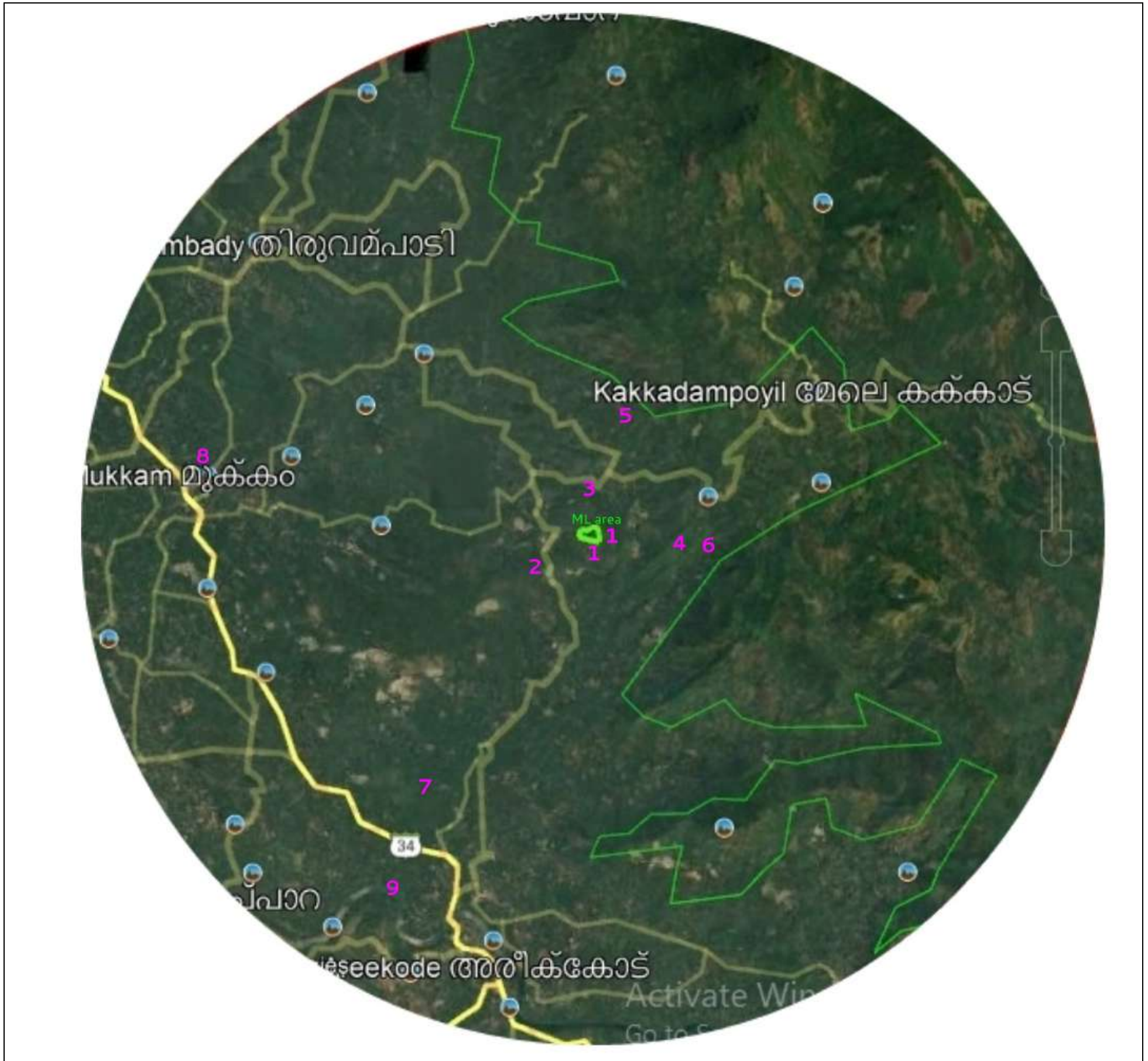
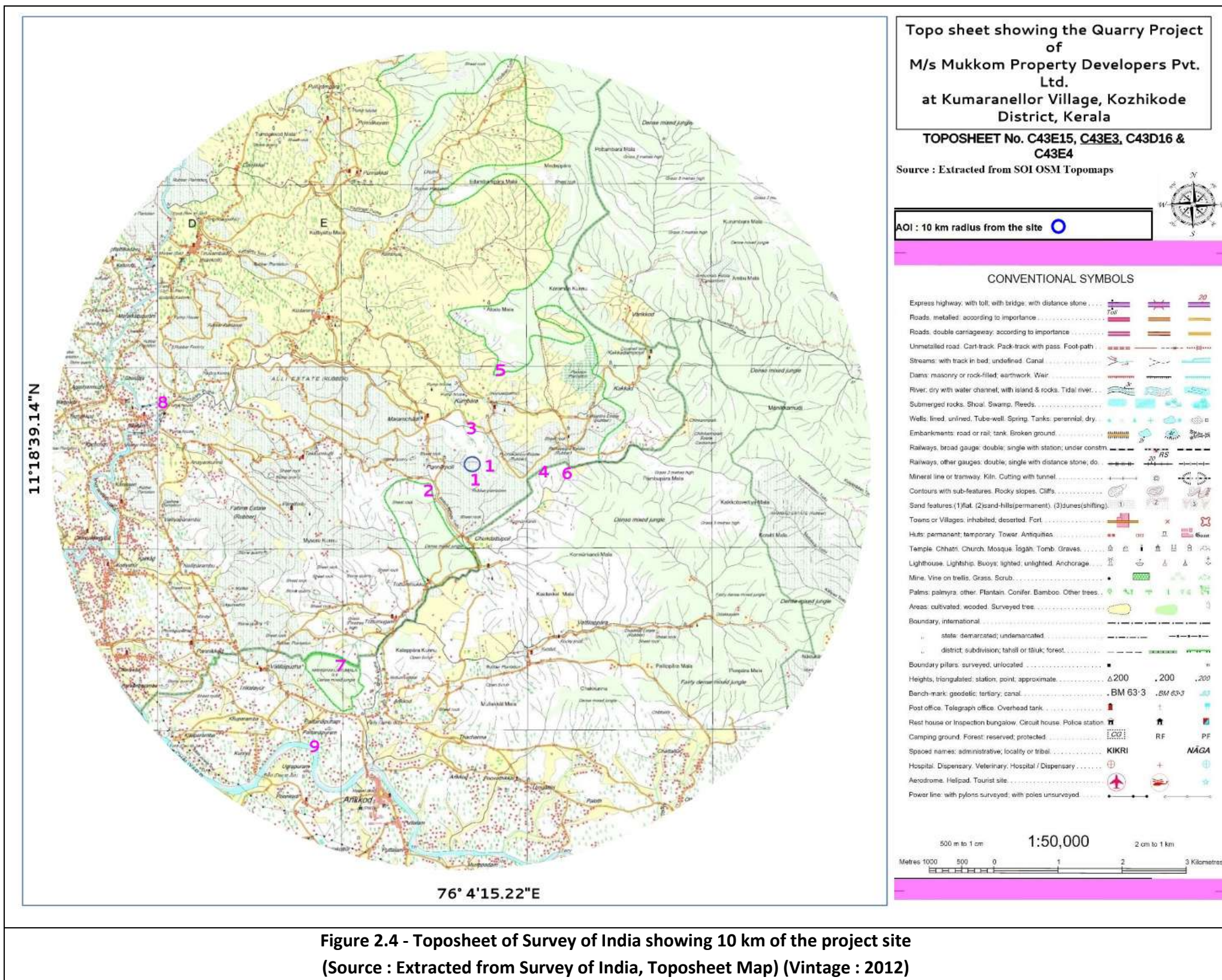


Figure 2.3 - Satellite map showing the important environmental features within the study area
(Source : Google Earth) (Vintage : August, 2023)



Inference

S.N.	Name	Distance & Direction
1.	Forest Area	101 m. (E & S)
2.	Dense Mixed Jungle (Chundattupoil)	1 km (SW)
3.	Branch of Iruvazhinji Puzha	1.5 km (N)
4.	Dense Mixed Jungle (Pambupara Mala)	2 km (E)
5.	Vellarimala Forest (Atodu Mala)	2.5 km (NE)
6.	Cherupuzha	2.7 km (E)
7.	Arimbrakuttumala RF (Kodumpuzha)	5.5 km (SW)
8.	Iruvazhinji Puzha	7.5 km (NW)
9.	Chaliyar River	8 km (SW)



Plate 2.1 (A) : Geo-tagged Site Photographs

(Source : During visit of EC & FAE)



Plate 2.1 (B)





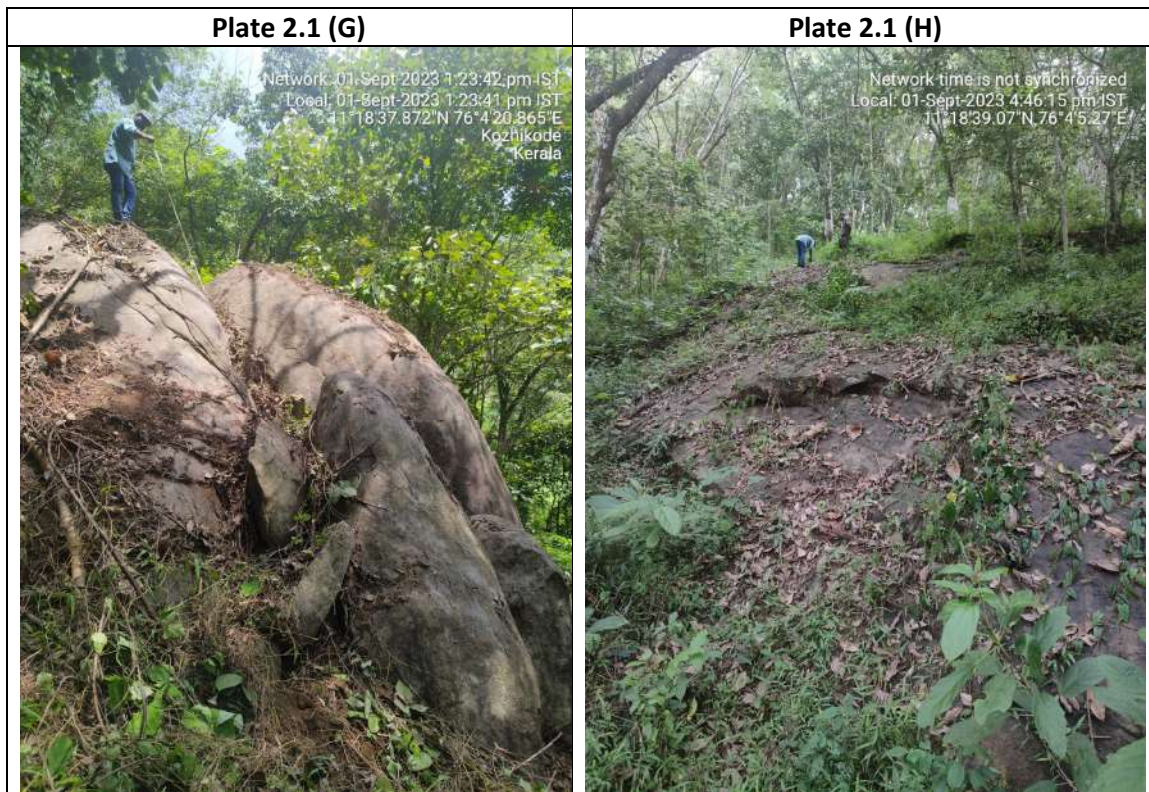


Table 2.2 : Environment Settings of the Project

Description	Aerial Distance & Direction
Nearest building / shed	Shed : 108.7 meters (near BP 1, NW direction) & Building : about 270 meters (near BP 1, NW direction)
Nearest Town	Mukkam 8 km (NW)
Nearest City	Kozhikode – 32 km (SW)
District Headquarter	Kozhikode Collectorate, Civil Station, Wayanad Road – 31 km (SW)
Nearest State Highway	S.H.34 (Koyilandy-Edavanna Road) – 7 km (SW)
Nearest National Highway	N.H. 966 (Kozhikode-Palakkad Highway) - 21 km (SW)
Nearest Railway Station	Nilambur Road Railway Station - 20 km (SE)
Nearest Airport	Kozhikode International Airport, Karipur – 22.5 km (SW)
Power supply	The total energy requirement will be 300 kW (75 kW x 4) for compressors which will be operated by Diesel Engine. The project has applied for dedicated feeder from KSEB supply.

Electrical installation like transformer /HT/LT line	Electric Lines – Thekkinkad 600 meters		
Mobile Towers	Maranchatty – 1.5 km (NW)		
Nearest Forests	S N	Name	Distance & Direction
	1	Forest Area	101 m. (E & S)
	2	Dense Mixed Jungle (Chundattupoil)	1 km (SW)
	3	Dense Mixed Jungle (Pambupara Mala)	2 km (E)
	4	Vellarimala Forest (Atodu Mala)	2.5 km (NE)
	5	Arimbrakuttumala RF (Kodumpuzha)	5.5 km (SW)
Nearest stream / rivers / water bodies (from ML area)	SN	Name	Distance & Direction
	1	Tributary of Iruvazhinji Puzha	1.5 km (N)
	2	Cherupuzha	2.7 km (E)
	3	Iruvazhinji Puzha	7.5 km (NW)
	4	Chaliyar River	8 km (SW)
Interstate Boundary	None within the study area*		
Critically Polluted Area as identified by CPCB	None within the study area*		
Defense installations	Areekode MSP Camp – 9 km SW		
Archeological Features	None within the study area*		
Ecological sensitive zone (National Park, Sanctuary, etc.)	None within the study area*		
ESA as per HLWG Report on Western Ghats	Kumaranellor village is not falling in the ESA village		

(*Study area is 10 km from the periphery of mine lease area).



2.1.4 Size or Magnitude of operation (Including associated activities required by or for the project)

The salient features of the project showing the size and magnitude of the operation is provided at Table 2.3.

Table 2.3 – Salient Features of the Project showing Size and Magnitude of Operation

Particulars	Remarks
Geological Mineral Reserves	1,34,95,553 MT
Mineable Reserves	62,00,436 MT
ROM (Run of Mine) (total)	64,49,975 MT
Life of Mine	20.67 Years say 21 years
Targeted Annual Production	3,00,000 MT (max.)
Highest and lowest elevation of ML area	195 AMSL (E) (near BP7 & BP8) & 60 AMSL (NW) (near BP1)
Ultimate depth of mining	45 AMSL
Working level of benches in conceptual phase	190 AMSL to 45 AMSL
Drainage direction	From East to West direction
Top Soil + Overburden	2,49,539 MT
Slope angle	Highest slope : 25 ⁰ and Lowest : 6 ⁰

Table 2.4 : Year wise production of building stone for life of mine

Year	Bench	Minerals (MT)
I	190-160	3,00,000
II	155-150	3,00,000
III	145-140	3,00,000
IV	140-135	3,00,000
V	130-125	3,00,000
VI	125-120	3,00,000
VII	120-115	3,00,000
VIII	115-110	3,00,000
IX	110-105	3,00,000
X	105-100	3,00,000
XI to XXI year	100-45	32,00,436
TOTAL		62,00,436



Water & Waste Water

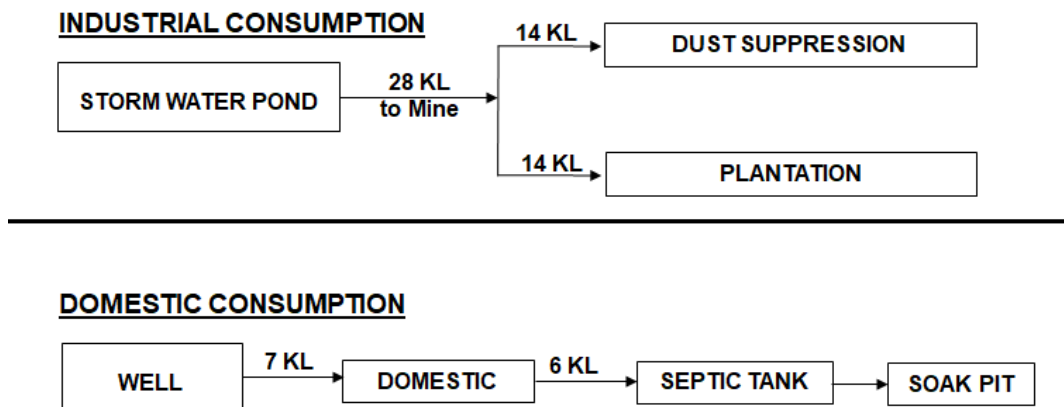
The specific water consumption for various purposes is worked out and is given in Table 2.5.

The daily water consumption balance chart is provided at Figure 2.5.

Table 2.5 - Water consumption details for various purposes

Sr. No.	Particulars	Water Requirement (in KLD)	Source
1.	Domestic purposes (mine staff)	7	Open well
2.	Dust Suppression / Water sprinkling at mine	14	Storm water pond
3.	Green belt / Plantation	14	
	Total	35	

Figure 2.5 - Daily water consumption balance chart



Daily waste water generation

About 6 KL of domestic waste water will be disposed off through soak pit.



2.1.4.1 Estimated Project Cost

The estimated project cost for the proposed quarry is calculated as **Rs. 12.197 Crores** and is provided at Table 2.6.

Table 2.6 – Calculation of Project Cost

Calculation of Project Cost for the proposed Quarry Project				
SN	Particulars	Amount (in Rs.)		
1. LAND COST				
Land cost – Applied Area : 8.1765 ha.				1,44,90,353
(Fare Value as per GOP No. 188/2014 dt. 14-11-2014 (1 Are=Rs. 15,000/-)				
(528.946839 Ares x Rs. 15,000/- = Rs. 79,34,202.528/-)				
(Fare Value as per GOP No. 188/2014 dt. 14-11-2014 (1 Are=Rs. 18,000/-)				
(364.230578 Ares x Rs. 18,000/- = Rs.65,56,150.404/-)				
2. MACHINERIES				
i)	Jack Hammer with lubricator (<i>make Atlas Kopco / Chicago pneumatics</i>) (32 mm drill hole size)	Rs.30,000	x 4 nos (3+1standby)	1,12,000
ii)	Compressor (1 Jack Hammer of 120 cfm), (4 Jack Hammer for 500 cfm) (electric / diesel)	Rs.13,00,000	x 4 nos (3+1standby)	52,00,000
iii)	Excavator (20 ton capacity)	Rs.76,00,000	x 3 nos.	2,28,00,000
iv)	Rock Breaker	Rs.21,00,000	x 2 nos.	42,00,000
v)	Excavator (30 ton capacity)	Rs.1,21,00,000	x 1 no.	1,21,00,000
vi)	Tipper (15 ton capacity)	Rs.58,00,000	x 4 nos.	2,32,000
Total				6,76,20,000
3. MICELLANEOUS MACHINERIES				
i)	Mobile Sprinkler arrangement with water tank and a truck for dust suppression and wetting of roads			15,00,000
ii)	Diesel Tanker (3000 ltr capacity)			23,00,000
iii)	Ambulance			14,00,000
iv)	Jeep			12,00,000
v)	D.G. set (300 kVA)			25,00,000
vi)	Fencing of mine lease area (Rs.220 per meter x 1,228 meters)			2,70,160
vii)	Siren, blast mats, safety devices			2,00,000
Total				93,70,160
4. ENVIRONMENTAL MONITORING PROGRAM				
				11,92,800
5. MAGAZINE INSTALLATION EXPENSES				
				12,00,000
6. SITE OFFICE + LABOUR SHEDS				
				22,00,000
7.MISCELLANEOUS EXPENSES AND APPROVALS				
(Statutory Fee at SEIAA, KSPCB, Public Consultation, Mining & Geology Etc.)				30,00,000
8. ENVIRONMENT MANAGEMENT PLAN (EMP)				
a.	Salient EMP measures like construction of garland drain + storm water collection pond + retaining walls at OB dump + Solar Lighting + Pump + PPEs etc.			1,64,00,000
TOTAL				11,54,73,313



b. CER Expenses (about @5.62% of the total project cost of Rs. 11,54,73,313/-)	65,00,000
GRAND TOTAL (1 to 8)	12,19,73,313 Say Rs. 12.197 Cr.

2.1.4.2 Employment Details

The employment details during mine operation is given below at Table 2.7.

Table 2.7 : Manpower Requirement for the project

SN	NAME OF THE POST	NOS.
1.	Mine Manager 1 st Class	1
2.	Environment Officer	1
3.	Mechanic (Vehicle and Machinery)	2
4.	Excavator (20 Ton capacity) Operator 1 st shift -(Caterpillar, JCB)	2
5.	Excavator (20 Ton, capacity) Operator 2 nd shift - (Caterpillar, JCB)	2
6.	Excavator (30 Ton, Capacity) Operator 1 st shift - (Caterpillar, JCB)	2
7.	Excavator (30 Ton, Capacity) Operator 2 nd shift - (Caterpillar, JCB)	2
8.	Mines foreman	2
9.	Mines mate	2
10.	Drilling	4
11.	Cleaning – Drilling helper	2
12.	Blasting helpers	2
13.	Quarry in-charge	1
14.	Quarry supervisor	2
15.	Mess (Cook - 1 no. + Helper – 1 no.)	2
16.	Tipper (Taurus) Drivers	6
17.	Tipper cleaners	6
18.	Office staff	4
19.	Helpers and cleaners	3
20.	Security	2
	TOTAL	50



2.1.4.3 Machinery details for the project

Machinery will be deployed as per requirement to meet production target. The details of the drilling & machines for the site is provided below table and the brief details of machinery is provided at **Annexure No. 2.3.**

Table 2.8 : Drilling & Machines for the Site

SN	Machine Type	Required No. of Machines	Size / Capacity	Make	Source of Power
1.	Jack hammer	4 (1 standby)	32 mm (drill hole size)	Atlas Copco	Operated through Compressor
2.	Excavator	4	0.9 m3	Tata -Hitachi	Diesel Engine
3.	Dumper / Tipper	6	15 T or 10T	Bharath Benz / Tata	Diesel Engine
4.	Rock Breaker	2	--	NPK	Diesel Engine
5.	Compressor	4 (1 standby)	100 CFM	LG / Atlas	Diesel Engine
6.	DG Set	1	300 kVA	CAT	Diesel Engine

Table 2.9 : Miscellaneous Machinery

SN	Particulars	Make/ Capacity	Number
1	Water Sprinkler for dust suppression	5 KL	1
2	Diesel Tanker	-	1
3	Ambulance	-	1
4	Jeep/ Van	Mahindra	2
5	Light Truck	Mahindra / Eicher– 5-6 Tonnes	1
6	Mobile workshop van	Assembled	1
7	Water tanker for plantation	5 KL	1

2.1.4.4 Trip Movement per hour from quarry

- Production capacity = 3,00,000 TPA= 1,000 TPD @300 working day
= 125 TPH @ 8 Hours working in a day
- Capacity of Tipper/Dumper = 15 MT / Trip
- No. of trips to crusher with mined material/ hr = 125 TPH / 15 tonnes
= 8.33 say 9 trips / hour



2.1.4.5 Size or Magnitude of associated activities (Crusher)

The rubble from the proposed mine will be sent to open market / stone crusher units located within 5 to 8 kms from the proposed mine site.

The aggregates from the proposed mine will be sold to Calicut Expressway Private Limited for construction of proposed six lining of existing Kozhikkode Bypass (Vengalam junction to Ramanattukara junction) as part of infrastructure works.

2.1.5 Proposed Schedule for approval and implementation.

The land procurement for the quarry site is already been carried out by the project proponent. In order to commence the mining activities, project proponent needs to mandatorily obtain the following statutory approvals:

1. Environmental Clearance from SEIAA, Kerala
2. Consent to Operate from Kerala State Pollution Control Board.
3. Explosive License
4. Panchayat License
5. Mining Lease from Mining & Geology Department

It is expected that a time period of 8-10 months is required for obtaining all the above mentioned approvals. Therefore, the project is expected to commence in 2024.

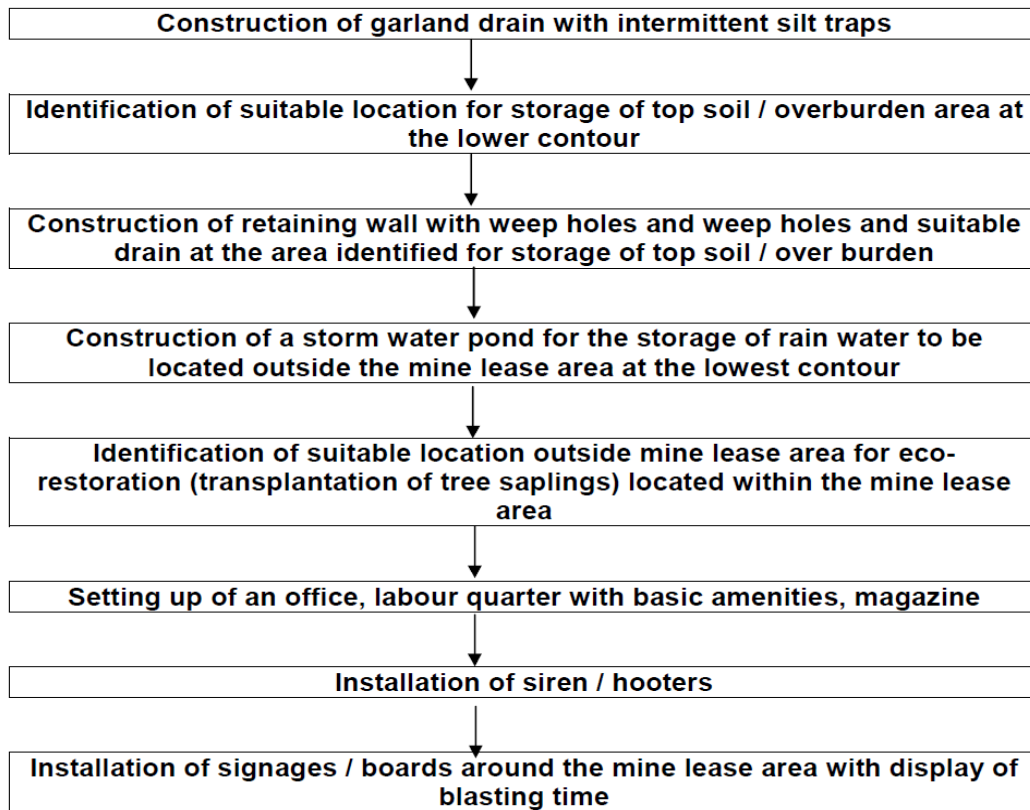
2.1.6 Technology and process description

Pre-mining activities: The proposed pre mining activities are defined below:

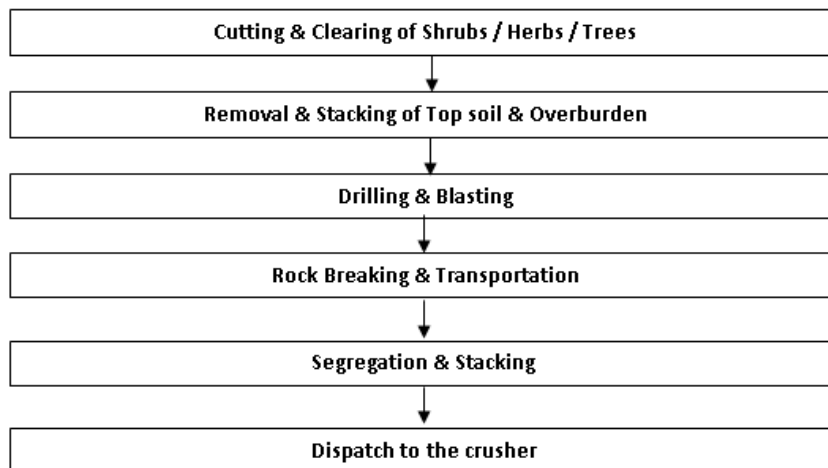
- Fencing the proposed mine lease area.
- Build / repair the connecting access roads to the quarry site.
- Construct rainwater drainage ditches containing soil and alluvial protection systems.
- Build a retaining wall in the lower area designated for topsoil storage.
- Make ditches in such a way that rainwater from the canals / thodu / storm water channel can reach the lowest point and in the proposed pond, make arrangements to drain only after the soil and silt have accumulated.



The process flow diagram given below depicts the mining process (pre-mining activities) with the sequence of activities of priority.



The proposed mining operations for the project will be carried out by open cast mechanized method of mining. The process flow diagram given below depicts the mining process.



1. Explosives to be Used

Only class 2 and class 6 explosive is proposed for use as given below. :-

Description	Class
Nitrate mixture	2, 0
Safety fuse	6, 1
NONEL Detonators/ Electrical Detonators	6, 3

2. Storage of Explosive

The magazine (explosive storage area) will be installed within the complex and would be stored outside the mine lease area as per the guidelines of Explosive Department.

As per the norms of Explosive Department 45 meter radius is to be kept as buffer area around the storage area of explosive.

2.1.7 Project Description including drawings showing project layout, component of projects etc., schematic representation of feasibility drawings which give information important for the EIA purpose.

Drilling

The number of holes to be drilled is decided on the basis of daily production. The drilling detail of the quarry site is discussed below:

Annual Production	3,00,000 MT
Daily Production	1,000 MT (@300 working days in a year)
No. of blasts in a day	3 Time (8.00 am to 8:15 am, 11.45 am to 12:00 noon & 2.45 pm to 3:00 pm)
Production per blast	$1,000 / 3 = 334 \text{ MT / blast}$
Rocks broken per hole	14.0625 MT say 14 MT / blast (Average Production per hole of depth 1.5 m to 2.5 m of 32 mm dia).
No. of holes	$334 \text{ MT} / 14 \text{ MT} = 23.85 \text{ Holes say } 24 \text{ Holes / Blast}$
Quantity of explosive per blast	500 gm per hole
Total quantity of explosives	$24 \text{ holes} \times 500 \text{ gm} = 12 \text{ kg/blast}$



Blasting Pattern:

- The blasting pattern entirely depends on the situation of the joints present in the rocks.
- The drilling is done as per the requirement of the rock fragmentation with desired production of mineral.

Per hole Explosive requirement per blast

- Column charge by 500 grams Nitrate mixture with Diesel and 250 gm NFO (Nitrate Mixture Class 2 Explosive) Cartridge for Bottom charge (total 500 gm).
- Stemming
- NONEL, Delayed electric detonators for supporting the control blasting.

Parking

The mine would provide vehicle parking facilities within the project premises. There is provision of wide entry / exits for the quarry project for easy & smooth vehicular movement.

Maps and Plans

The Production and Development Plan with Section, Conceptual Plan with Section of the proposed quarry project is attached as **Annexure No. 2.4 (A&B) & Annexure No. 2.5 (A&B)**.

2.1.8 Description of Mitigation measures incorporated into the project to meet environmental standards, environmental operating conditions, or other EIA requirements.**2.1.8.1 Land Environment:**

1. The topsoil excavated from the quarry will be dumped / stacked separately at pre-determined place at lower contour of mine with retaining wall and weep holes will be provided and subsequently this will be utilized in spreading over reclaimed areas for plantation as part of eco-restoration.
2. The overburden (OB) will be generated throughout the mine life. This waste will be utilized within the pit and for laying of haul roads. At the end use, OB can be reutilized as soil base for plantation.

2.1.8.2 Water Environment:

1. Storm water garland drains with intermittent silt traps will be suitably constructed all along the periphery of the pit area to collect the run-off from the lease area and divert into the storm water pond proposed outside the mine lease area.
2. The rain water store will be utilized to meet all industrial water requirements.



3. A bund will be constructed at the edge of bench to prevent direct fall of run-off.

2.1.8.3 Noise & Vibration Environment:

1. Proper maintenance of machinery, equipments and improvement on design of machines.
2. Providing PPEs i.e., earmuffs and earplugs to workers,
3. Regular noise monitoring at suitable locations
4. NONEL blasting technique for blasting.
5. Blast mats to muffle the blasting.
6. Charge per delay will be as per the safety norms

2.1.8.4 Ecological Environment:

1. A 7.5 m wide green belt would be developed all around the periphery of the ML area.
2. Native species would be planted as part of afforestation.
3. Planting of saplings would be initiated from day 1 onwards.

2.1.8.5 Socio-Economic Environment:

1. Generation of direct & indirect employment opportunities (50 direct and 100 indirect).
2. More ancillary activities will be developed

2.1.8.6 Air Environment:

1. Laying of haul roads as per the standards, black topping/cement paving / concreting of permanent haul roads and service roads to avoid or eliminate air – borne dust.
2. Wetting of haul roads and other roads at regular intervals through mobile sprinkler system of 5 KL capacity.
3. Provision of green belt all along the periphery of the lease area.
4. The extracted mineral will be transported within the quarry project area or nearby crusher by adopting following measures so as to minimize dust emissions.
 - The trucks after loading will be covered with tarpaulin sheets when moving outside quarry project area.
 - Speed of the vehicles will be maintained within the prescribed limits.
 - Trucks will not be over loaded and will be maintained to the body level.
 - The wetting of materials before transfer of materials.



2.1.9 Assessment of new and untested technology for the risk of technological failure.

No new and untested technologies would be followed. The mining operations as explained in the section 2.1.6 above would be followed in the mining operations.



CHAPTER – 3

DESCRIPTION OF THE ENVIRONMENT

3.0 DESCRIPTION OF THE ENVIRONMENT

Introduction

In Chapter 2 (Project Description), it is observed that there is no Ecological Sensitive Area (ESA) / Ecological Sensitive Zone (ESZ) located within 10 kms from the periphery of ML area. However, beyond 100 meters from the eastern and southern periphery of the proposed project site, there is forest land. Further, there is a First Order stream located in the north-west direction of the site and also there is a seasonal storm water drain in the west direction. As explained, presently the nearest house is located at about 270 meters (near BP 1, NW direction) from the periphery of the proposed ML area. Further, the proposed mining area is with moderate slope (around 25⁰).

This chapter deals with the baseline environmental status of various facets of environment not only for the proposed ML area but also for the surrounding area keeping in mind the environmentally sensitive features as provided above.

3.1 Study area, Period, Components & methodology

3.1.1 Study Area

MoEF&CC has issued Standard ToR (Terms of Reference) for EIA study. Further, "*Environmental Impact Assessment Guidance Manual for Mining of Minerals projects*" is published by Ministry of Environment & Forests, February, 2010, for carrying out an EIA study of a mining project.

The mine lease area is called as "core zone" (8.1765 ha.) and 10 km from the boundary of the core zone is considered as "buffer zone". The instant proposal is not falling within the cluster of quarries. Therefore, the **study area** includes the "core zone" and the "buffer zone" (study area) only. The satellite image showing the "core zone" and the "buffer zone" is provided at Figure 3.1.



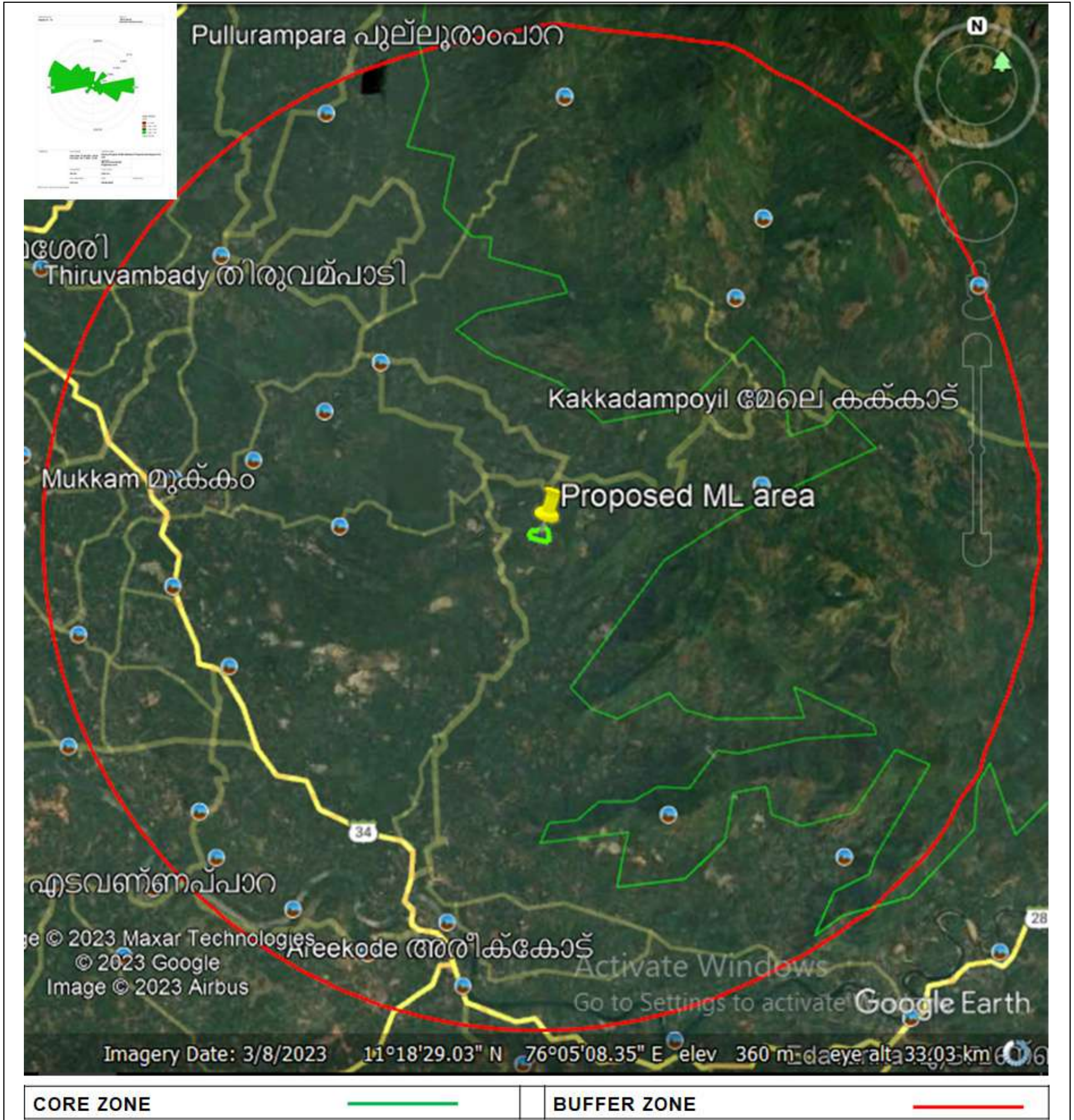


Figure 3.1 – Satellite map showing Core zone, Extended Core Zone & Buffer zone for impact assessment and baseline monitoring
 (Source : Extracted from Google Earth & Vintage : August, 2023)

3.1.2 Study period

The study period for the EIA project is September, October & November, 2023 (Post-monsoon season) (one season).

3.1.3 Components of study

The environmental baseline study includes inventory of physical, ecological and socio-economic parameters. The baseline environmental parameters for various components viz., ambient air, ambient noise, water (surface and ground), soil samples were collected and analysed for various parameters through M/s Standards Environmental & Analytical Laboratory, a laboratory accredited with National Accreditation Board for Laboratories (NABL) (Accreditation no. TC-5402). Further, the studies related to ecology and biodiversity, socio-economic profile of the area, traffic and road network pattern etc. were carried out by the NABET approved Functional Area Experts. The component of the study encompasses all the requirements of Standard and Specific ToR.

The data has been compiled for the following :

- **Land Environment** : land use / land cover, topography, drainage pattern, local geology & regional geology and soil characteristics.
- **Water Environment**: water consumption and sources, ground & surface water its characteristics. The characterization of surface water includes upstream and downstream of the natural stream located in the immediate vicinity.
- **Ambient Noise Environment & Vibration** : noise levels covering residential, commercial, industrial and sensitive zones. Vibration levels of mining due to blasting and other operation (secondary data). Further, vibration study on the zone of influence and impact of blasting on the neighbourhood as per O.M. dt. 29-10-2014 issued by MoEF.
- **Ecological Environment** : identification and enumeration of flora & fauna (terrestrial) and habitat of the study area.
- **Socio-Economic Environment** : demography, employment, cropping pattern.
- **Ambient Air Environment** : air quality with respect to significant parameters.



3.2 Establishment of baseline for valued Environmental components as identified in the scope.

- Wind Rose Diagram, Upwind and Downwind direction, predominant wind direction, facing of the quarry. Further, the natural barriers existing in the vicinity are also kept in mind.
- Sensitive Receptors
- Location of Ecologically Protected Areas
- Location of water bodies (surface water & ground water)
- Nearby buildings / structures / habitations

3.2.1 Sampling, Frequency & Method of Baseline Environment Monitoring

Environmental Attributes

A. Land Environment

Parameters (Soil Sampling) : pH, Conductivity, Water Holding capacity, Organic matter, Porosity, Soil Texture (type), Total Nitrogen as N, Pottassium as K, Total Phosphorous as P, Permeability.

No. of Samples : One from Core zone (lower portion) and Other three from Buffer zone within 0.5 km (study area) (influence zone) (Total 4 samples).

Frequency : Once in a season for each location.

Measurement Method : Collected and analyzed as per the protocol of Agriculture Department

B. Water Environment

Parameters (Water Sampling) : Turbidity, pH, Total Dissolved Solids, Total Alkalinity, Total Hardness, Chloride, Sulphate, Nitrate, Fluoride, Magnesium, Iron, Total Ammonia, Lead, Copper, Cadmium, Mercury, Zinc, Arsenic, Chromium, Nickel, Dissolved Oxygen, Biochemical Oxygen Demand (3 days at 27⁰C), Chemical Oxygen Demand, Total Coliform Bacteria, E coli.

No. of Samples : Set of grab samples for Ground water (2 samples) nearby Mine Area Open Wells and 2 samples for Surface Water including upstream and downstream of the nearby natural stream (Total 4 samples)

Frequency : Once in season for each location.

Measurement Method : Samples for water quality is collected and analysed as per IS:10500:2012



C. Noise Environment & Vibration

Parameters : Hourly equivalent noise levels.

No. of Samples : One sample at core zone (Mine area) and Other five samples within study areas (nearby House / Sensitive Receptors like School, College). (Total 6 samples).

Frequency : Once in a season.

Measurement Method : Noise level meter.

D. Ecological Environment

Parameters : Flora, Fauna Enumeration and Biodiversity.

No. of Samples : Within the Core zone, extended core zone and Buffer zone (study area).

Frequency : Once in a season.

Measurement Method : Qualitative floral assessment by quadrat method & Transect method.

F. Socio-Economic Environment

Parameters : Socio-Economic assessment & Need assessment study.

No. of Samples : Within the buffer zone.

Frequency : Once in a season.

Measurement Method : Primary and Secondary data.

F. Air Environment**Meteorological**

Parameters : Temperature, rainfall and wind.

Based on the IMD data of Kozhikode (Secondary data) (the nearest station at Kozhikode at about 33 km from the site in west direction).



Ambient Air

Parameters : . PM₁₀, PM_{2.5}, SO₂, NO₂, CO & Lead.

No. of Samples : One sample at core zone, One sample is selected in the upwind direction / sensitive receptor (school) and Four sampling locations are selected at the Sensitive Receptors. (Total 6 samples).

Frequency : 24 hourly, once in a month (one season).

Measurement Method : As per CPCB guidelines.

3.3 Facets of Environment

3.3.1 Land Environment

Land Environment : Protocols for Soil sampling methodology

The protocol issued by Soil Testing Laboratory, Agricultural Department, Govt. of Kerala regarding the collection, preparation & transportation of soil samples is followed and the methodology description is provided at **Annexure No. 3.1.**

Introduction

Since mining is essentially excavation of mineral, the land environment greatly affected by the mining operation in the case of open cast mine.

Local Geology of the quarry site:

The proposed quarry site is located on the SW side slope of a NW-SE trending low level ridge with a maximum elevation of 195 M above MSL. Rock assemblage consists of massive charnockite and hornblende - biotite gneiss. Strike of foliation of gneisses is ENE- WSW (80⁰-260⁰), dips towards NNW direction at shallow angle (Plate 1). Three prominent sets of joints/fractures have been observed : 1) NW – SE (320⁰-140⁰), 2) NNE – SSW (20⁰- 200⁰) and 3) WNW – ESE (3100-1300) (Plate 2). Pegmatitic intrusions are found along the fractures in NNE-SSW direction (Plate 3). Average thickness of topsoil is 1.49 m.





Plate 3.1 : Foliation in hornblende - biotite gneiss
(Source :- Photo taken during field visit by FAE) (Vintage : September, 2023)



Plate 3.2 : Joints in NNW- SSE direction
(Source :- Photo taken during field visit by FAE) (Vintage : September, 2023)



Plate 3.3 : Pegmatite intrusion along fractures in NNE – SSW direction
(Source :- Photo taken during field visit by FAE) (Vintage : September, 2023)

Geology of the Kozhikode District (Regional Geology):

The district can be divided into three geological belts viz., (i) a linear NW-SE trending gneissic belt, along the middle extending from north to south, (ii) a charnockite belt occupying areas in the northeast and south, extending to the adjacent districts and also occurring as pockets within the gneissic terrain and (iii) a narrow coastal belt.

Granite gneiss belonging to the Peninsular Gneissic Complex is the oldest unit of the area and occurs north of Alampore. Charnockite belonging to the Charnockite Group has a very wide distribution, especially in the northeast and south with variations like biotite-hypersthene gneiss, biotite-hornblende-hypersthene gneiss and hornblende hypersthene gneiss. Magnetite quartzite, another unit of this group, occurs as narrow linear bodies within charnockite. Hornblende-biotite gneiss of the Migmatite Complex extends from north to south and is well foliated. Garnetiferous quartzo-feldspathic gneiss, another member of Migmatite Complex, occurs as lenses within charnockite, in the east. NW-SE trending dolerite dykes. These dykes are 10-20m wide.

Pebble beds occur on the coast and along banks of the Beypore river. The pebble bed is associated with grit and clay and it is lateritised. It comprises well rounded pebbles of quartz, granite, quartzite and granulite. It is considered to be of Pleistocene origin. Sporadic laterite is recorded from the charnockite country to the southwest. Quaternary deposits are of marine and fluvial origin. Periyar Formation is a fluvial deposit comprising an admixture of sand, silt and clay. Guruvayur Formation is a strand line deposit of palaeo-marine origin and mostly comprises medium- to fine sand. Kadappuram Formation represents contemporary marine deposits, constituting the present and barrier beach.

(Source – District Survey Report, Kozhikode District published by Mining & Geology Dept., Govt. of Kerala (November 2016))

Loose boulders in the ML area

During the field survey of the ML area by the Functional Area Expert Sh. Mathews J.M. together with the Team Member Sh. Yedhukrishna, it is found that there are loose boulders of various sizes present in ML area (mining area & 7.5 meters buffer around mining area), Outside the ML area upto 75 meters from the periphery of ML area. The details of the boulders are given below table :-



Table 3.1 – Details of Loose boulders in ML area & 75 meters outside the periphery of ML area

Boulder No	Locations			Length (m)	Width (m)	Height of Boulder (m)
	Latitude	Longitude	a. Mineable area b. Buffer-7.5 m. c. Near to Buffer upto 10 m. d. Outside ML area between 10 to 75 m			
1	11°18'47.20"N	76° 4'17.06"E	Outside ML area	3	3	4.5
2	11°18'47.32"N	76° 4'17.00"E	Outside ML area	3.1	3	4.1
3	11°18'37.55"N	76° 4'20.82"E	Mineable area	1.8	1	2.5
4	11°18'37.78"N	76° 4'20.87"E	Mineable area	2	3	4.2
5	11°18'37.68"N	76° 4'21.06"E	Buffer - 7.5 M	2	3	4
6	11°18'37.67"N	76° 4'21.23"E	Near to Buffer	3	2.1	3.1
7	11°18'37.48"N	76° 4'21.41"E	Near to Buffer	3.1	3	3
8	11°18'37.11"N	76° 4'21.59"E	Outside ML area	1.5	1	2.3
9	11°18'36.78"N	76° 4'21.92"E	Outside ML area	1	0.8	1.5
10	11°18'37.29"N	76° 4'21.91"E	Outside ML area	1	1	1.6
11	11°18'37.29"N	76° 4'21.89"E	Outside ML area	1.1	1	1.5
12	11°18'37.27"N	76° 4'21.85"E	Outside ML area	1	1.2	1.6
13	11°18'37.63"N	76° 4'21.03"E	Buffer - 7.5 M	1	1.5	1.5
14	11°18'37.10"N	76° 4'23.20"E	Outside ML area	2.5	0.8	0.8
15	11°18'37.08"N	76° 4'23.18"E	Outside ML area	2	0.8	0.7
16	11°18'37.03"N	76° 4'23.19"E	Outside ML area	4.1	3.1	1.1
17	11°18'37.43"N	76° 4'23.71"E	Outside ML area	3.4	1.4	2.8
18	11°18'37.18"N	76° 4'23.90"E	Outside ML area	4	3.4	3
19	11°18'37.56"N	76° 4'23.21"E	Outside ML area	1.8	2.5	3.4
20	11°18'37.97"N	76° 4'23.73"E	Outside ML area	2.3	1.5	3.3
21	11°18'38.83"N	76° 4'19.27"E	Mineable area	2.1	1.2	3.5
22	11°18'38.80"N	76° 4'19.21"E	Mineable area	1.1	1	1.3
23	11°18'38.80"N	76° 4'19.21"E	Mineable area	1.1	1.2	1.3
24	11°18'36.87"N	76° 4'16.58"E	Mineable area	9	3	7
25	11°18'36.95"N	76° 4'16.54"E	Mineable area	4	2	4.1
26	11°18'37.04"N	76° 4'16.68"E	Mineable area	3.6	3.1	4.1
27	11°18'36.94"N	76° 4'16.75"E	Mineable area	2.8	1.3	3.1
28	11°18'37.00"N	76° 4'16.78"E	Mineable area	2.7	1.4	3
29	11°18'36.93"N	76° 4'16.72"E	Mineable area	8.4	8	10.2
30	11°18'37.59"N	76° 4'15.29"E	Mineable area	5.1	1.7	6.1
31	11°18'37.99"N	76° 4'16.05"E	Mineable area	3.7	1.8	5.8
32	11°18'42.58"N	76° 4'14.06"E	Outside ML area	1	1.1	1.2



33	11°18'41.46"N	76° 4'13.03"E	Mineable area	4	2.4	1.4
34	11°18'41.54"N	76° 4'13.04"E	Mineable area	2.8	2.3	1.5
35	11°18'39.40"N	76° 4'7.12"E	Outside ML area	1	2.1	2
36	11°18'39.64"N	76° 4'7.00"E	Outside ML area	1	1	1.5
37	11°18'39.60"N	76° 4'7.19"E	Outside ML area	6.5	2.5	4
38	11°18'36.83"N	76° 4'13.73"E	Mineable area	2	2.1	2.3
39	11°18'36.86"N	76° 4'14.20"E	Mineable area	1.8	2.1	2
40	11°18'37.48"N	76° 4'12.08"E	Mineable area	1.3	1	1.5
41	11°18'37.45"N	76° 4'12.26"E	Mineable area	1.1	1.4	2



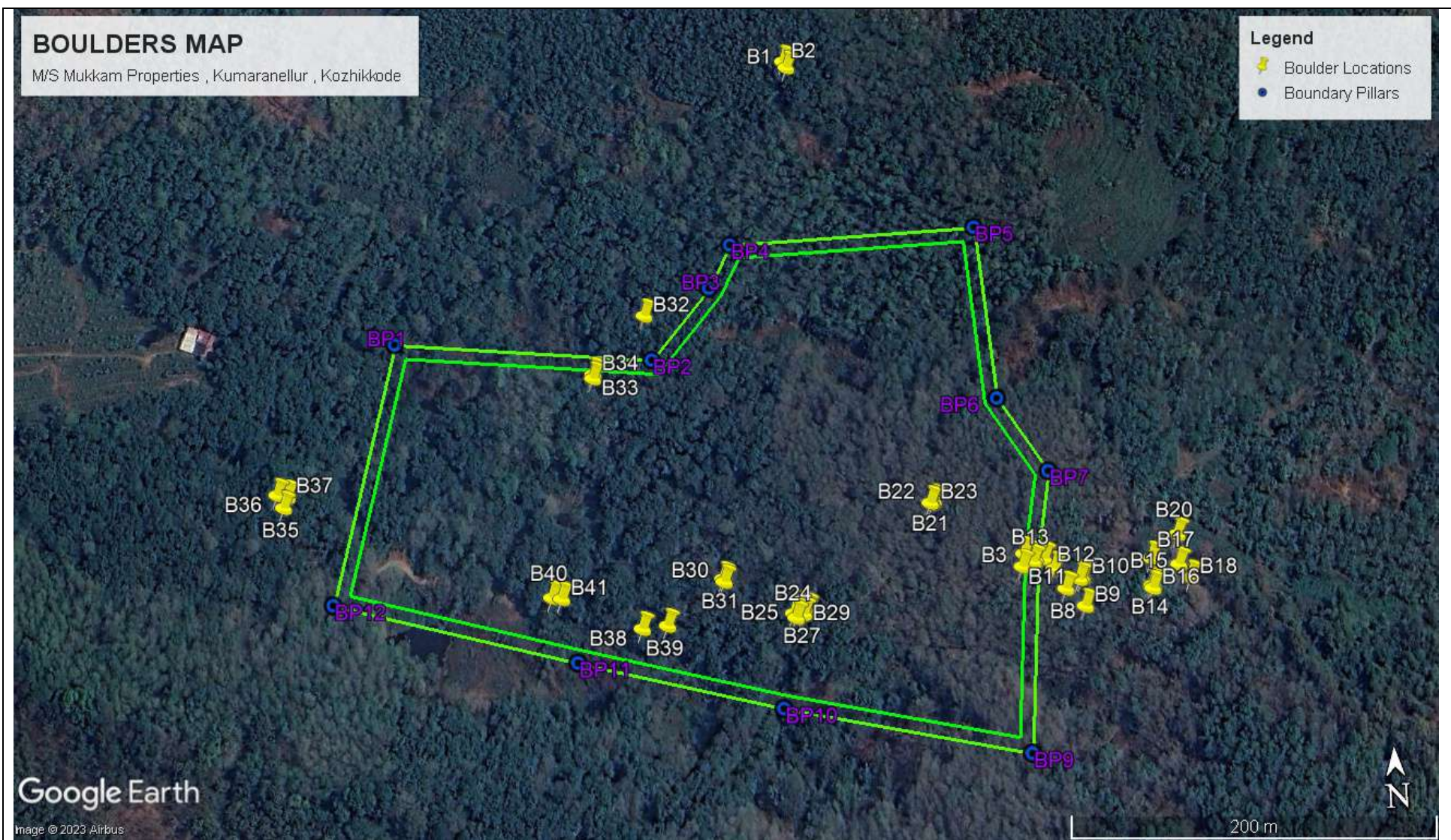


Figure 3.2 : Map showing location of loose boulders within Mineable area, Buffer-7.5 m., Near to Buffer upto 10 m. & Outside ML area between 10 to 75 m.

Top Soil & Over Burden calculation

To ascertain the quantity of top soil and over burden in the mine lease area, pitting studies were carried out at different identified locations. The map of the mine lease areas showing the location of pitting carried out to determine the depth of topsoil and overburden in the ML area is provided at Figure 3.3. The table showing the location of pitting carried out and the depth of top soil / overburden in each pitting location is at Table 3.2.

Table 3.2 - Pitting details of the proposed quarry site

Pit No.	Pitting location		Mineable area & Buffer-7.5 m.	Thickness (In m.)
	Latitude (N)	Longitude (E)		
Pit-1	11°18'43.92"	76° 4'17.95"	Buffer	1.50
Pit-2	11°18'42.62"	76° 4'16.40"	Mineable area	2.0
Pit-3	11°18'42.51"	76° 4'17.99"	Mineable area	1.40
Pit-4	11°18'42.40"	76° 4'19.68"	Mineable area	2.80
Pit-5	11°18'41.95"	76° 4'14.47"	Buffer	Rock Exposure
Pit-6	11°18'41.48"	76° 4'16.07"	Mineable area	1.0
Pit-7	11°18'41.37"	76° 4'18.01"	Mineable area	3.20
Pit-8	11°18'41.15"	76° 4'19.87"	Mineable area	0.20
Pit-9	11°18'42.11"	76° 4'11.67"	Buffer	Rock Exposure
Pit-10	11°18'41.33"	76° 4'9.19"	Buffer	0.50
Pit-11	11°18'41.01"	76° 4'11.38"	Mineable area	3.0
Pit-12	11°18'40.55"	76° 4'14.20"	Mineable area	2.10
Pit-13	11°18'40.05"	76° 4'16.64"	Mineable area	0.70
Pit-14	11°18'39.71"	76° 4'18.80"	Mineable area	1.60
Pit-15	11°18'38.98"	76° 4'20.06"	Mineable area	2.30
Pit-16	11°18'40.41"	76° 4'20.83"	Buffer	2.40
Pit-17	11°18'37.87"	76° 4'18.71"	Mineable area	0.90
Pit-18	11°18'38.49"	76° 4'16.59"	Mineable area	2.10
Pit-19	11°18'38.88"	76° 4'14.21"	Mineable area	1.30
Pit-20	11°18'39.36"	76° 4'11.71"	Mineable area	3.80
Pit-21	11°18'39.71"	76° 4'9.27"	Mineable area	0.60
Pit-22	11°18'38.08"	76° 4'8.92"	Mineable area	3.60
Pit-23	11°18'37.43"	76° 4'11.17"	Mineable area	4.0
Pit-24	11°18'36.85"	76° 4'13.66"	Mineable area	1.0
Pit-25	11°18'36.12"	76° 4'16.01"	Mineable area	Rock Exposure
Pit-26	11°18'35.68"	76° 4'18.69"	Mineable area	0.70
Pit-27	11°18'35.70"	76° 4'20.85"	Buffer	1.70
Pit-28	11°18'35.47"	76° 4'16.88"	Buffer	Rock Exposure
Pit-29	11°18'37.30"	76° 4'10.14"	Buffer	Rock Exposure
Pit-30	11°18'37.34"	76° 4'20.56"	Mineable area	0.50



Geological cross sections have been drawn at fixed intervals across the mine area. The Section line along which the Geological Sections have been prepared which is shown in the Surface cum Geological Plan.

Section	Quantity (cu.m.)
AA'	58548
BB'	40280
CC'	13091
DD'	12850.48
Total	1,24,769.5

The average thickness of topsoil & overburden is 1.49 m.

Categorization	Thickness of Top Soil / Over burden
High	Above 3 m.
Medium	Between 1.5 m. - 3 m.
Low	Less than 1.5 m.

The ML area is categorized as "Low" .





**Figure 3.3 – Map showing the Pits location within the mine lease area
(Source : Pit locations marked by the FAE)**

Top Soil + Overburden : A total quantity of 2,49,539 tons of topsoil + overburden is proposed to be removed during the entire mining operations (throughout the mine life, 1st to 21st year).

a. The life of mine is for about 21 years and therefore, the generation of top soil + OB is for a period of 21 years. The year-wise generation of top soil & OB, its concurrent use and the area earmarked for its storage is provided below :-

Year	Top Soil + Overburden (in cu.m.)	Top Soil + Overburden (in MT)
I	15000	30000
II	12500	25000
III	10000	20000
IV	10000	20000



V	10000	20000
VI	10000	20000
VII	10000	20000
VIII	7500	15000
IX	7500	15000
X	7500	15000
XI to XXI	24769.5	49539
Total	1,24,769.5	2,49,539

Years	Top soil + Overburden (MT)	Area (ha.)
I - XXI	2,49,539 (concurrently used)	0.53 (outside the lease area, in own land)

- b. **Management of Top Soil + Over Burden (OB)** :- The quantity of top soil + OB to be generated at the end of 1st year of mining operation is 15,000 cu.m. and which will be used for eco-restoration of the mined out area of the 1st year during the 2nd year of mining operations concurrently and also concurrently used for construction of haulage roads during the 1st year of mining operations. Therefore, the maximum storage area needed is only for a quantity of 15,000 cu.m. (maximum quantity at the end of the 1st year and for the entire life of mine). This concurrent eco-restoration and other activities using OB like construction of protection wall in the storage area of top soil & OB, construction of garland drains, storm water collection pond etc. will be repeated till the end of mining operation and therefore at any point of time the maximum storage area needed is only for 15,000 cu.m. Considering the maximum height of dump storage as 5 – 8 meters, the storage area required is 2,500 sq.m. and the area earmarked is 5,303 sq.m. and which is provided outside the ML area and in the lowest contour. Or in other words, the total quantity of generation of top soil + OB cu.m. 1,24,769 cu.m. will never be at the site and hence, no storage area is required for this quantity. Shrubs and herbs will be developed over the dump yard for stabilization of the top soil dump.



- c. The Environmental Plan (Plate No. 7) which is part of the approved Mining Plan depicts the earmarked area for the storage of top soil and O.B.
- d. Storage area of top soil and overburden will be provided with protection wall in downslope. This wall will be provided with weep holes. A drain to collect the seepage will be provided and which will be connected to the storm water collection pond.

Stripping ratio

The stripping ratio is the ratio of overburden in cubic meters to mineral in tones. Most of the mine lease area is covered with native tree species having top soil / overburden.

The stripping ratio of the proposed quarry site is given below :-

Year	Top soil + Overburden	Mineral	Top soil + overburden + mineral (ROM)	Stripping ratio
	MT			
I	30000	300000	330000	1:0.1
II	25000	300000	325000	1:0.083333
III	20000	300000	320000	1:0.066667
IV	20000	300000	320000	1:0.066667
V	20000	300000	320000	1:0.066667
VI	20000	300000	320000	1:0.066667
VII	20000	300000	320000	1:0.066667
VIII	15000	300000	315000	1:0.05
IX	15000	300000	315000	1:0.05
X	15000	300000	315000	1:0.05
XI to XXI	49539	3300436	3249975	1:0.015479
Total	2,49,539	6200436	6449975	1:0.040245

From the above, it is inferred that the Stripping ratio is 1:0.040245 which is much below 1.



Soil Sampling

The location of soil sampling points are presented in Table 3.3 and Figure 3.4.

Table 3.3 - Soil Sampling Locations

Station no.	Geo-coordinates	Location	Distance & Direction from project area	ML area / Study area
SS-1	11°18'36.54" (N) & 76° 4'23.18" (E)	Outside ML area (Upper portion)	50 m. outside ML area (East direction)	Study area
SS-2	11°18'40.46" (N) & 76° 4'10.42" (E)	Within the ML area (Lower portion)	Within the ML area (Lower portion)	Within the ML area
SS-3	11°18'42.51" (N) & 76° 4'6.70" (E)	Outside ML area	about 80 m. (NW direction)	Study area
SS-4	11°18'43.25" (N) & 76° 3'54.39" (E)	Outside ML area	about 450 m. (W direction)	Study area
SS-5	11°18'41.36"(N) & 76° 3'58.57"(E)	Outside ML area (area proposed for Compensatory plantation)	about 300 m. (W direction)	Study area

Reason for selection of Soil Sampling locations

The above locations are selected for the purpose of determination of soil characteristics (fertile soil or not) keeping in mind the eco-restoration activity in the mine closure phase and also to determine the characteristics of the soil at which the compensatory afforestation is proposed.



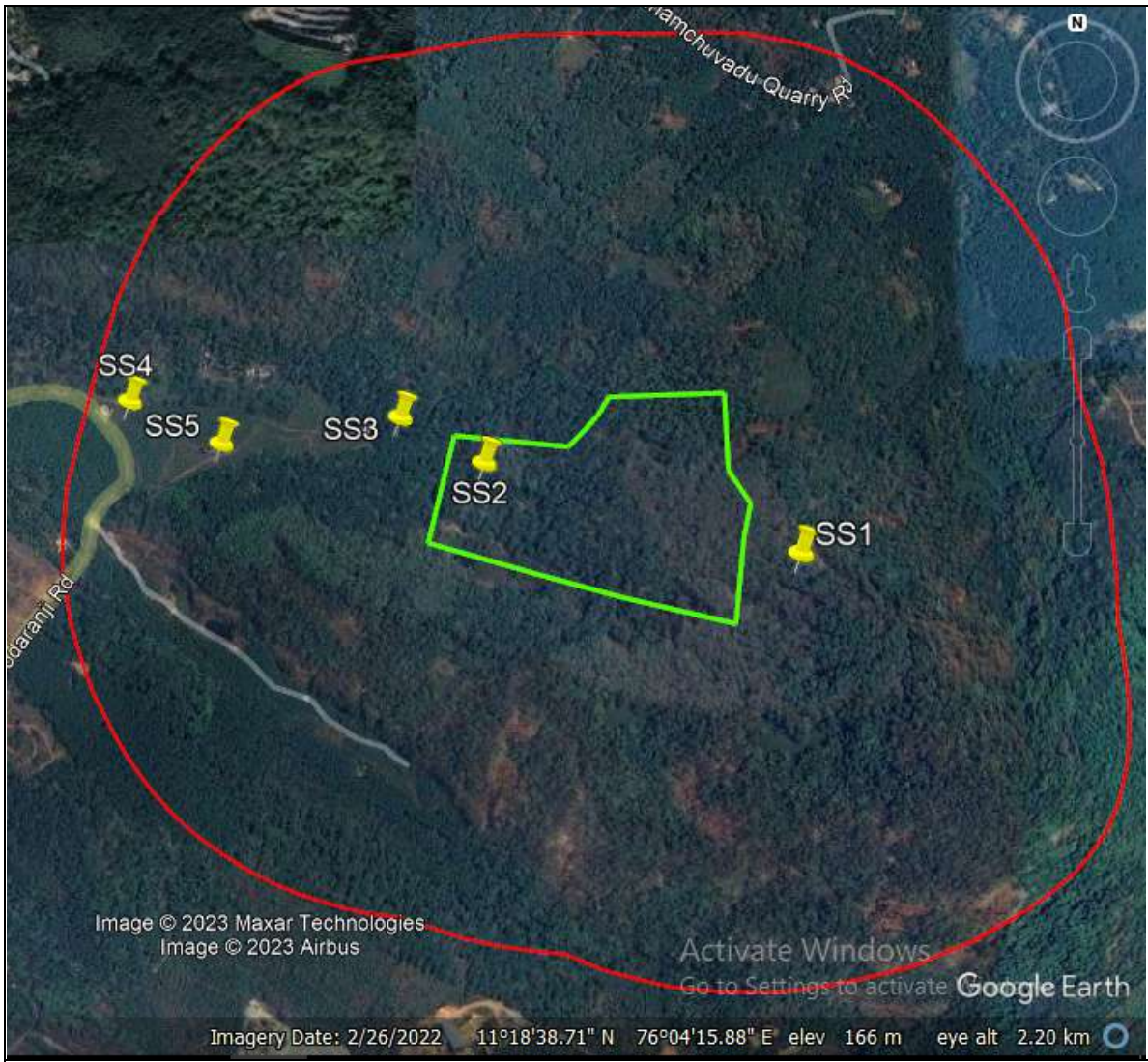


Figure 3.4 : Soil Sampling Locations

Source :- Extracted from Google Earth map (Vintage : 2023)

Soil Quality Analysis

The soil sample was collected in presence of the functional area experts and analysed by NABL accredited laboratory, during September, 2023 and the results are given in Table 3.4.

Table 3.4 - Chemical & Physical Properties of Soil Sample Results (M/s Standards Laboratory)

Sr. No.	Parameters	Unit	Analyzed values from Samples			
			SS-1	SS-2	SS-3	SS-4
1.	pH	--	4.74	4.87	4.85	4.79
2.	Conductivity	μS/cm	20.0	24.0	30.0	28.0
3.	Water holding capacity	%	55.0	58.0	55.0	52.0
4.	Organic Matter	%	0.30	0.32	0.33	0.35
5.	Porosity	%	36	36	35.0	24.0
6.	Soil Texture (type)	--	Sandy – Clay	Sandy – Clay	Sandy – Clay	Sandy –Soil
7.	Total Nitrogen as N	mg/kg	0.35	0.32	0.33	0.30
8.	Potassium as K	mg/kg	360	378	380	300
9.	Total Phosphorous as P	mg/kg	81.0	83.0	45.9	54.3
10.	Permeability	mm/s	0.003	0.003	0.003	0.004

Sr. No.	Parameters	Unit	SS-5 (Soil Testing Laboratory, Agriculture Department) (Near proposed Compensatory Plantation area)
1.	pH	-	6.30
2.	TSS	EC in mhos/cm	0.075
3.	Organic Carbon	%	1.49
4.	Phosphorus (P)	(kg/ha.)	11
5.	Potassium (K)	(kg/ha.)	179
6.	Calcium	ppm	0.0
7.	Magnesium	ppm	0.0
8.	Sulphur (S)	ppm	5.4
9.	Boron (B)	ppm	0.4
10.	Iron (Fe)	ppm	59.1
11.	Manganese (Ma)	ppm	16.7
12.	Zinc	ppm	15.2
13.	Copper (Cu)	ppm	5.4

The analysis reports of soil sampling stations (core zone & study area) are provided at **Annexure No. 3.2 (A, B, C, D, E).**



The Standard Soil Classification is provided at Table 3.5.

Table 3.5 – Standard Soil Classification

S.No.	Parameters	Classification
1.	pH	<4.5 extremely acidic 4.51 – 5.0 very strong acidic 5.01 – 5.5 strongly acidic 5.51 – 6.0 moderately acidic 6.1 – 6.5 slightly acidic 6.51 – 7.3 Neutral 7.31 – 7.8 slightly alkaline 7.81 – 8.5 moderately alkaline 8.51 – 9.0 strongly alkaline >9.0 Very strongly alkaline

(Source: Standard Soil Classification published by ICAR)

Interpretation

- On comparison of the analyzed value of soil samples (pH) with Standard Soil Classification of ICAR, the interpretation is provided below :-

Parameters	SS-1	SS-2	SS-3	SS-4	SS-5
	Core Zone	(Study area)			
pH	Very strong acidic	Very strong acidic	Very strong acidic	Very strong acidic	Slightly acidic

- The fertility of soil is poor and not productive for plant growth during the eco-restoration stage.
- The characteristics (fertility) of soil suitable for Mango tree plantation is provided as a suggestion in the report of Agriculture Department in the compensatory plantation area.

Topographical contour plan

The topographical contour map of the proposed ML area of 8.1765 ha. is given below :



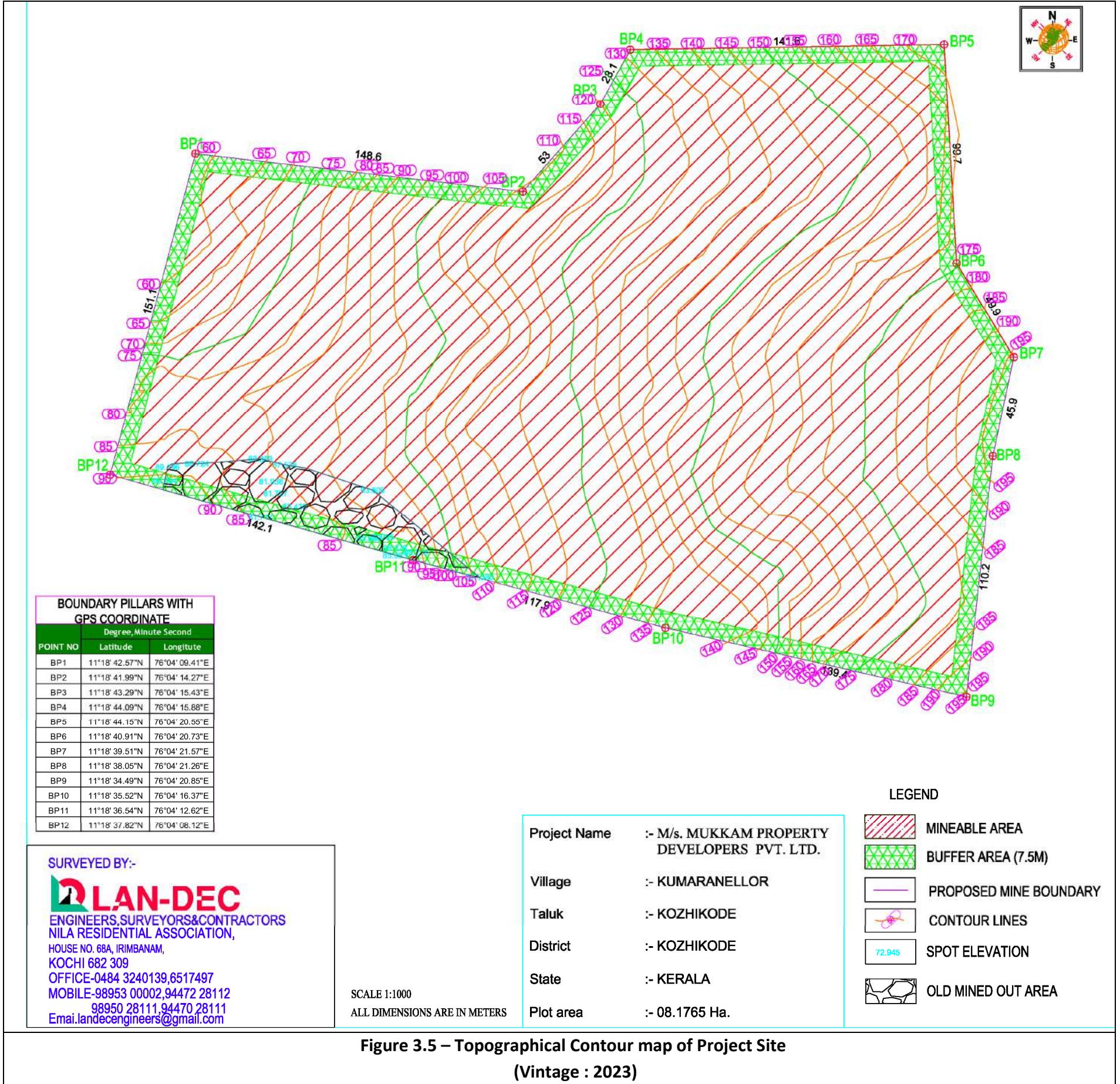


Figure 3.5 – Topographical Contour map of Project Site (Vintage : 2023)

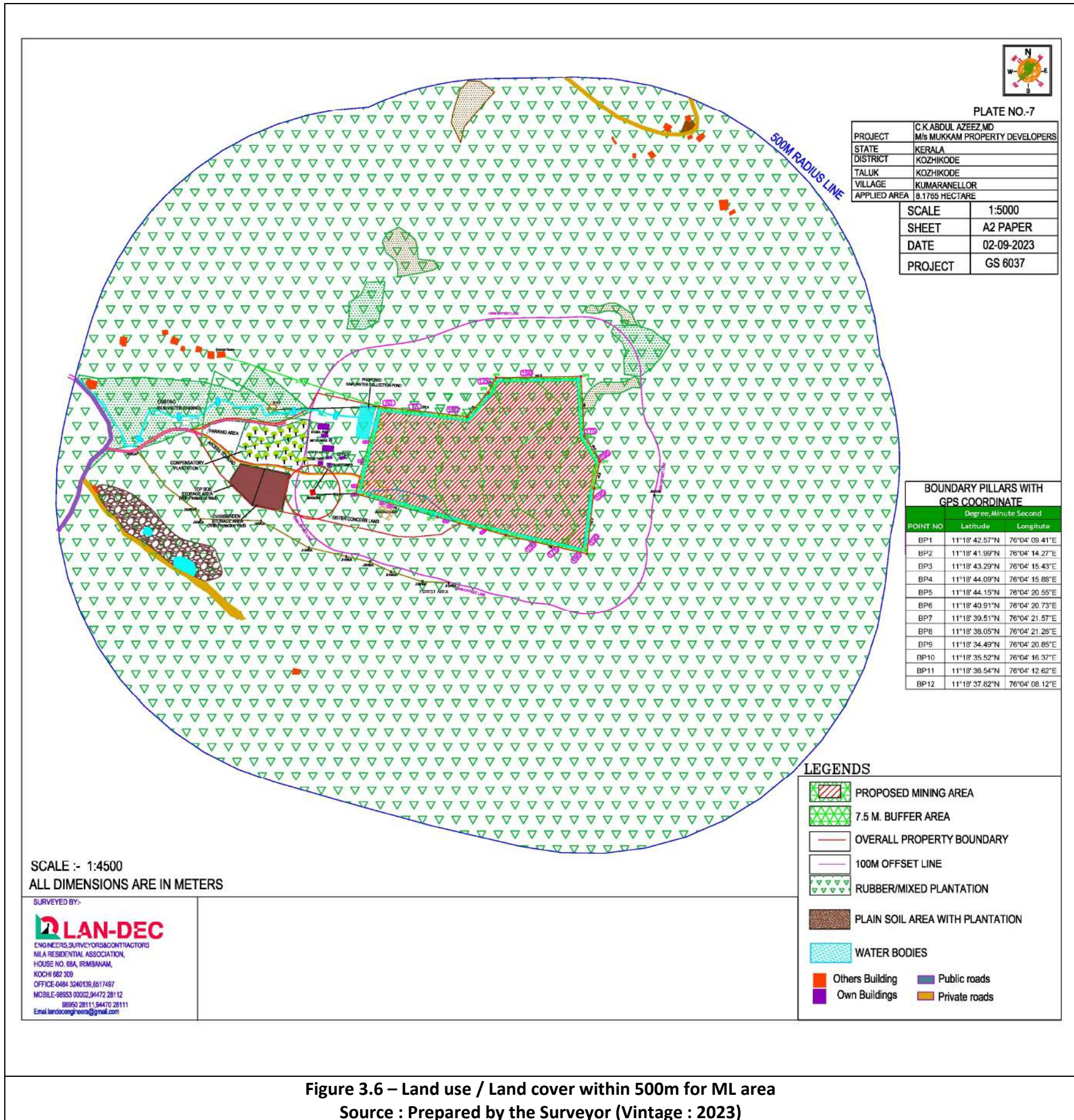
Interpretation:-

- Highest Level = 195 AMSL (E) (near BP7 & BP8)
- Lowest Level = 60 AMSL (NW) (near BP1)
- Drainage Pattern = From East to West



Land Use / Land Cover of Core area and Study Area

Land Use / Land Cover of ML area and 500 m. from the periphery (primary data)



Interpretation :-

The land use of the study area within 500 meters from the periphery of ML area comes under Rubber Plantation / Mixed Plantation. Also, there is storm water drain in the west direction of the proposed ML area. In the south & east direction, there are "Forest Area" available in the surrounding area. Also, it is observed that, there is a small old abandoned quarry pit located near to BP11 & BP12.

Land Use / Land Cover of ML area and 500 m. from the periphery (Secondary data),

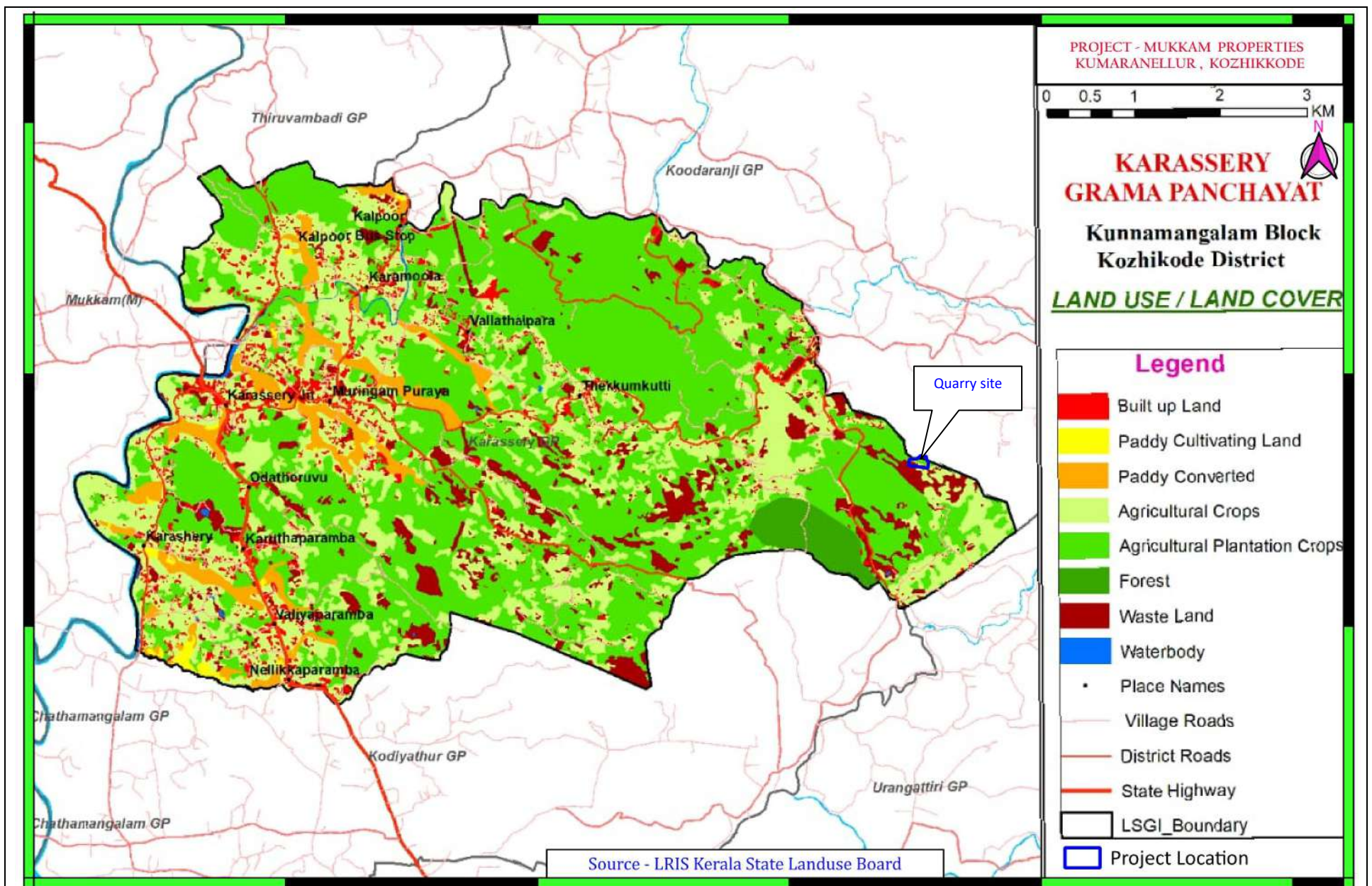


Figure 3.7 – Land use / Land cover map of Karassery Grama Panchayat
 Source : Web GIS based Land Resource Information System (LRIS) Land Use Board of Kerala (Vintage : 2023)

Interpretation

As per the Web GIS based Land Resource Information System (LRIS) Land Use Board of Kerala, part of the existing land use of the project site is “Part of the ML area falling within the “Waste Land”, “Agricultural Crops” & “Agricultural Plantation Crops”.

Land Use / Land cover as per Revenue Record, Govt. of Kerala

As per the Non-Assignment certificates from Village Office, Kumaranellur stating that this land is not assigned for any special purposes, not involved in reserve forests, there is no court / bank attachments, this land is not in right of Schedule Tribe. Also, there is no Schedule Settlements within 500 meters from the periphery of project boundary. The copy of the Non-Assignment Certificates is attached at **Annexure No. 3.3**.

Seismic Zone Classification

The proposed project is falling in Zone III on the MSK Scale (IS 1893: 2002) as per seismic zone classification map which indicates the area to be prone to moderate intensity of earthquake as shown in Figure 3.8.



Figure 3.8 - Earthquake Zonation Map
 (Source: Maps of India, www.mapsofindia.com) (Vintage : 2012)

Interpretation :-

As per seismic zone classification map, the proposed project is falling in Zone III on the MSK Scale (IS 1893: 2002) which indicates the area to be prone to moderate intensity of earthquake. The mining activities will be carried out as per the DMG Guidelines and with the Eco-friendly approved Mine Plan.



The following documents are referred for identification of the Land Use / Land cover of the core area and the study area :

1. Block map from Revenue Department

The project is located in Kumaranellur Village, Kozhkode Taluk & District. The area is unsurveyed and hence Block map is not available for Kumaranellur Village. From the approved sketch, there is Forest Area available which is located about 101 m. away from the ML boundary.

2. Coastal Zone Management Plan (CZMP) prepared under CRZ Notification, 2011 approved by MoEF&CC to know the CRZ status for project attracting CRZ regulations

The project site is located in Kumaranellur Village, Kozhkode Taluk & District and there is no tide influenced water body located abutting to the site and hence there is no applicability of CRZ Notification, 2011 / 2019 to the instant project.

3. KML Google map

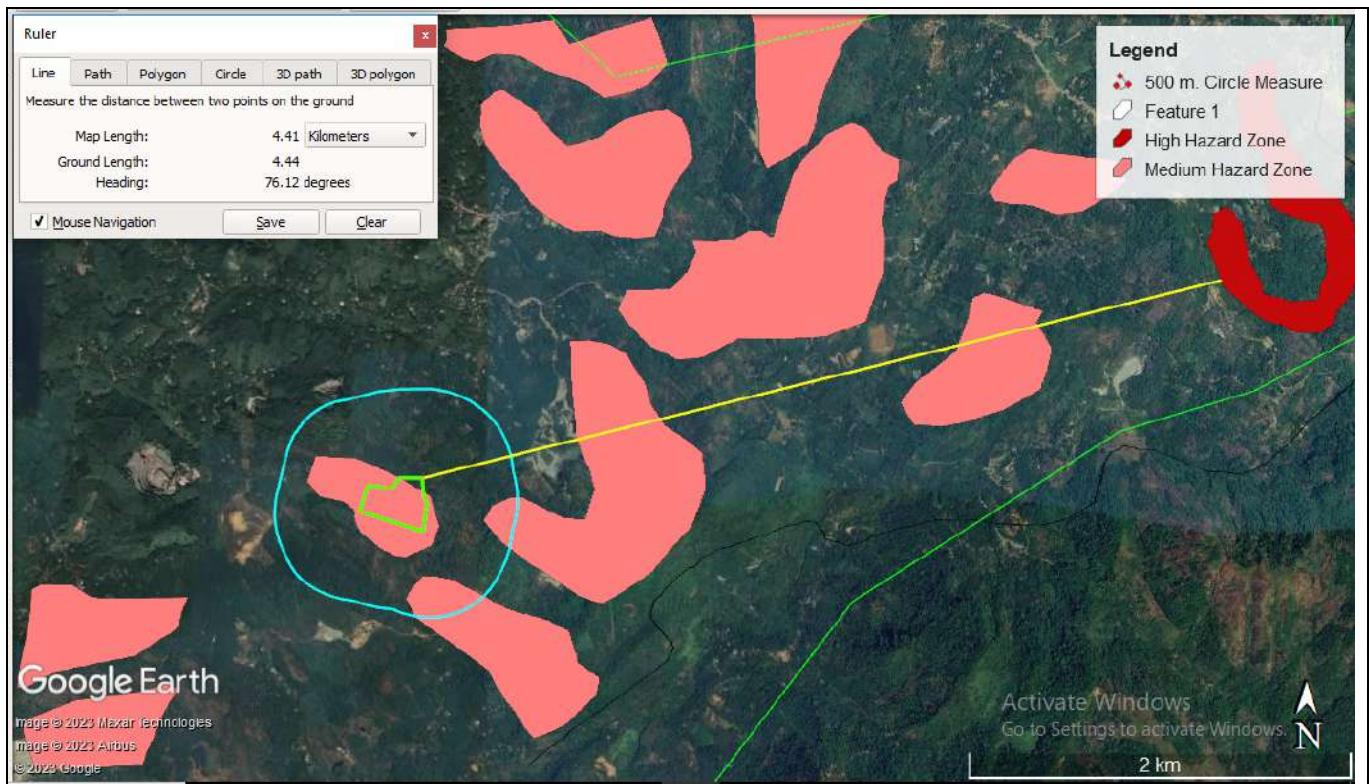
The Geo coordinates of Google map (KML) superimposed with project boundary is provided at Chapter-2 (Ref. Figure 2.2). From the satellite image of the site, it can be observed that the mine lease area is new quarry and there is small portion existing old mine (pit) in the SW direction. Predominant floral species in the ML area is Rubber.

4. Landslide Zonation Map prepared by State Disaster Management Authority, Kerala

As per the Landslide Zonation Map prepared by State Disaster Management Authority (SDMA) of Kerala, it can be inferred that the most of the ML area is falling within Medium Hazard Zone area (Moderate Zone) and remaining area is safe zone. The nearest High Hazard Zone is 4.4 km (NE direction) from the proposed ML area.

The satellite image showing the ML area overlaid on the Landslide Hazard Zonation Map of SDMA is provided at Figure 3.9.





**Figure 3.9 - Landslide zonation map showing ML area & 500 m outside the ML area
(Source :- Extracted from KSDMA, Google KML file) (Vintage : October, 2023)**

5. Flood Zonation Map prepared by State Disaster Management Authority, Kerala

The flood zonation map published by State Disaster Management Authority, Kerala is referred and the mine lease area boundary superimposed on the flood zonation map is provided at Figure 3.10. From the map it can be inferred that the Mine Lease (ML) area and 500 meters outside from the periphery of ML area is not in the flood prone area. The nearest flood prone area is located at 1.3 km in NE direction from the boundary of project site.

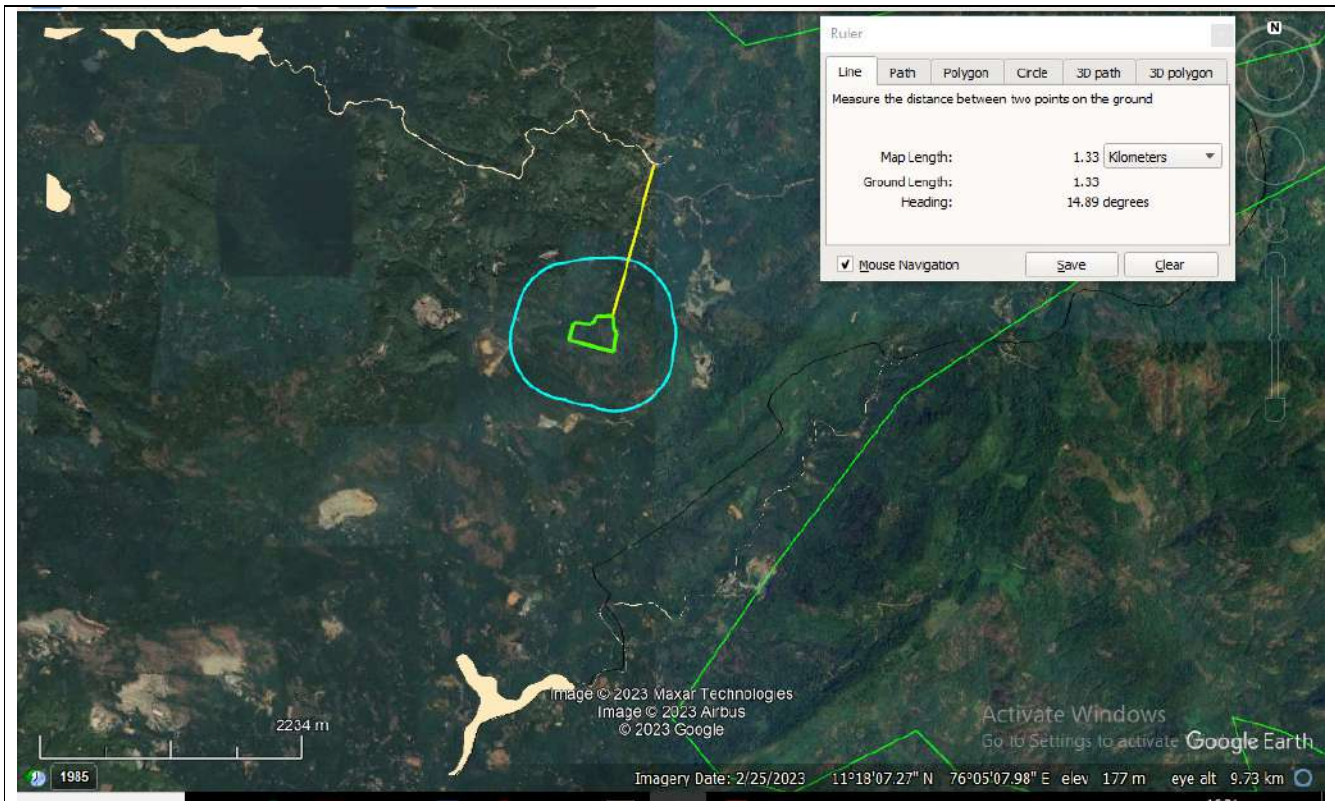


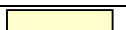


Figure 3.10 - Flood zonation map showing ML area & 500 m outside the ML area
 (Source :- Extracted from KSDMA, Google KML file) (Vintage : February, 2023)

	ML boundary
	500 m. boundary
	Flood prone area

6. List of Ecologically Protected Areas (Wildlife Sanctuary & National parks) Published by Kerala Forest Institute (KFRI), Govt. of Kerala

As informed earlier, there is no Wildlife Sanctuary / National park located within 10 kms from the boundary of mine lease area.

7. List of Centrally Protected Monuments under Archeological Survey of India within the State of Kerala dated 14-12-2017

As per the list of Centrally Protected Monuments under Archeological Survey of India within the State of Kerala, there is no protected monument located within the study area.

8. List of Critically Polluted Area (CPA) and Severally Polluted Area (SPA) (The CEPI scores for industrial areas / clusters descending order published by MoEF dt. 13-01-2010)

There is no critically polluted area within the study area.



9. List of Ecologically Sensitive Area (ESA) villages published by MoEF based on High Level Working Group (HLWG) report on Western Ghats (Dr. K. Kasturirangan Report)

Kumaranellur Village is not in the list of Ecologically Sensitive Area (ESA) villages published by MoEF based on the HLWG report.



Slope of the ML area and the surroundings
Slope Section :

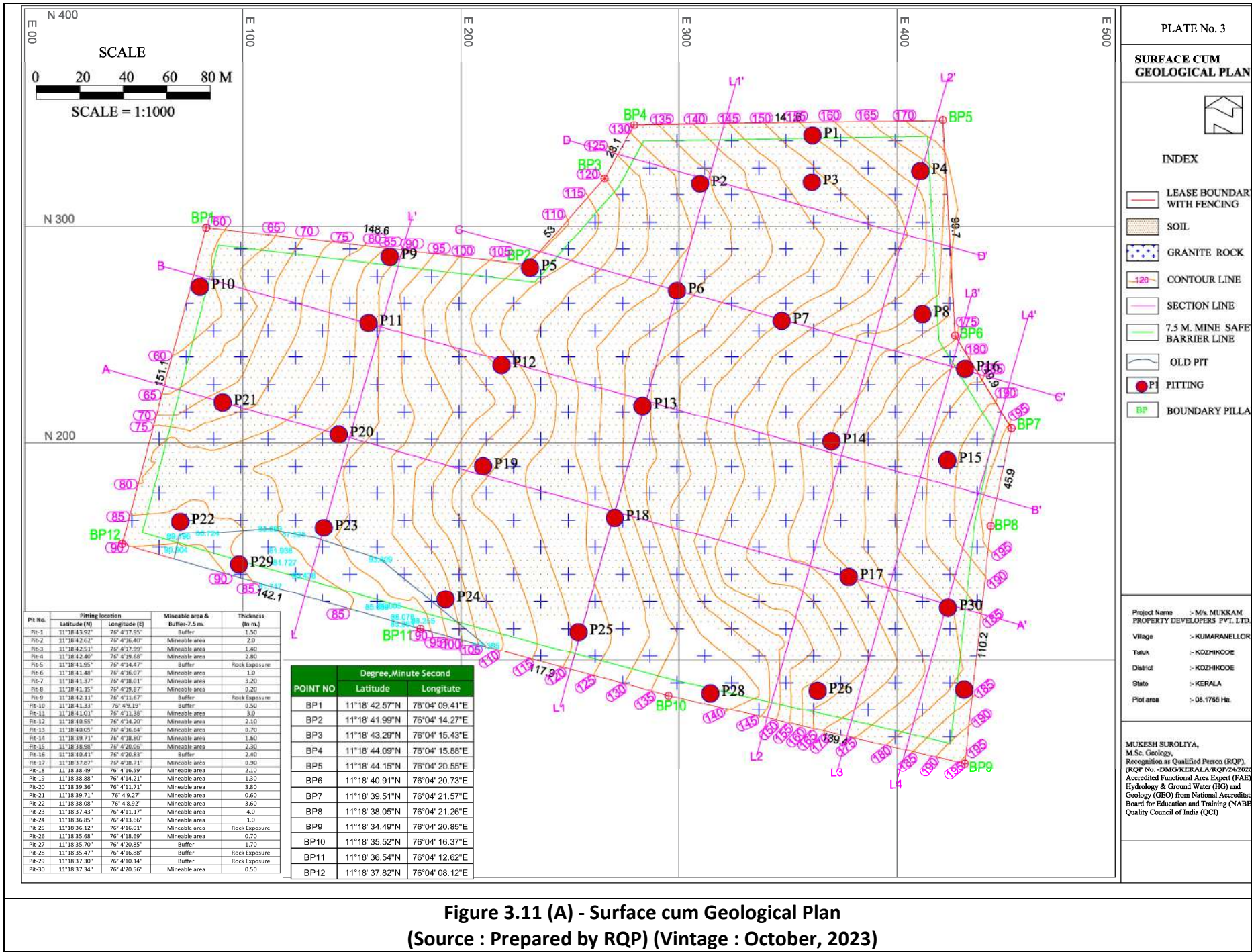


Figure 3.11 (A) - Surface cum Geological Plan
(Source : Prepared by RQP) (Vintage : October, 2023)



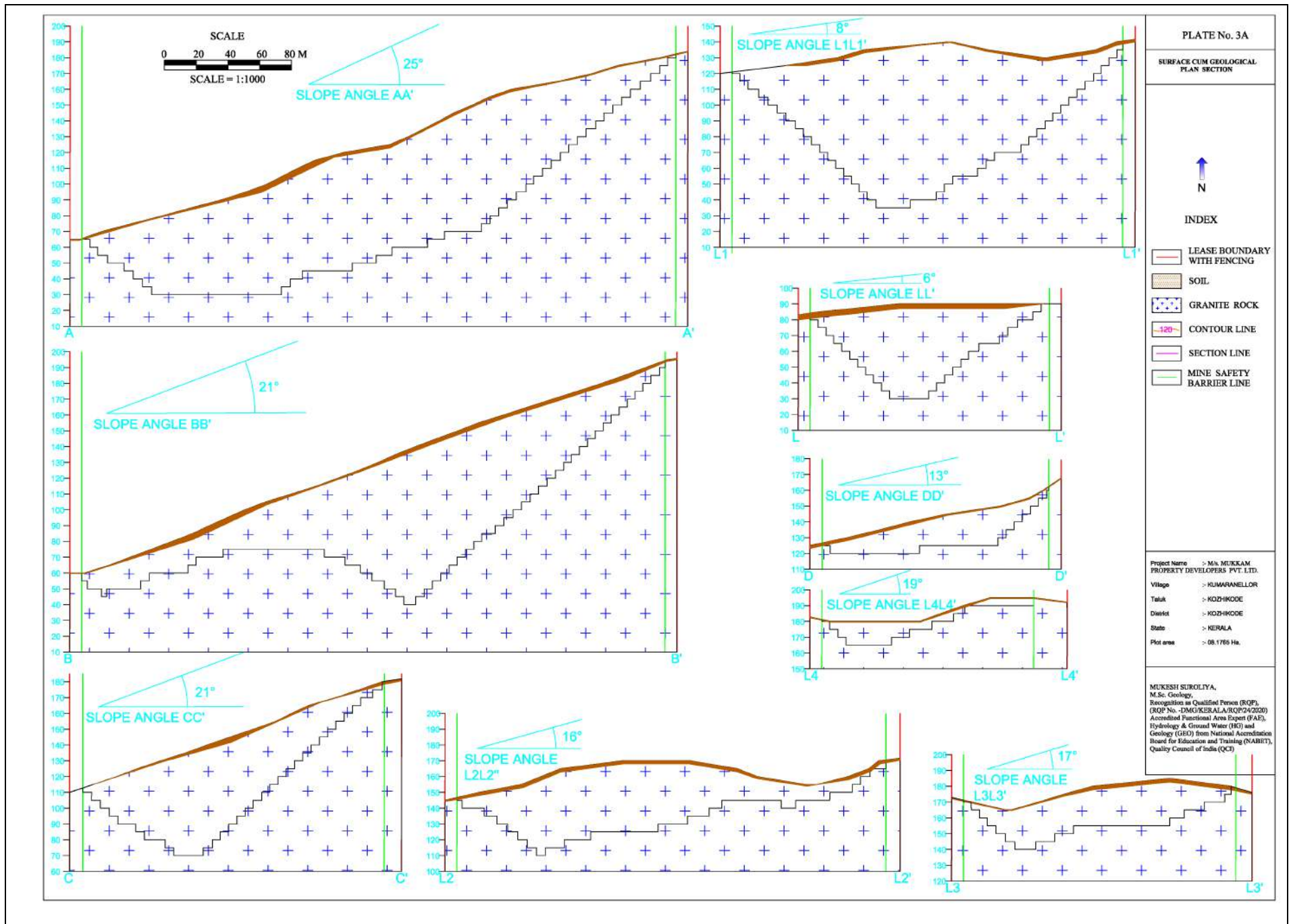


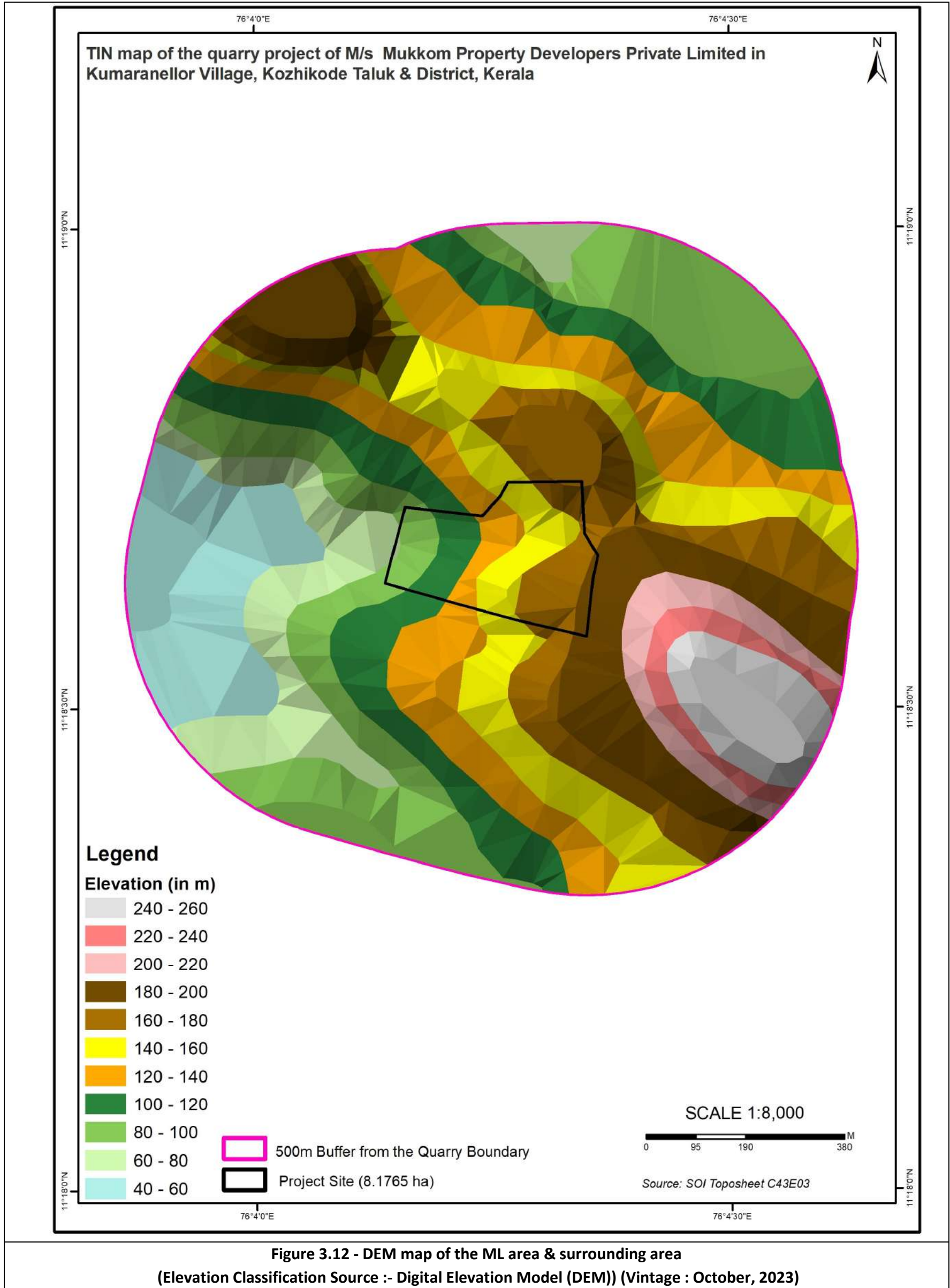
Figure 3.11(B)- Surface cum Geological Section
 (Source : Prepared by RQP) (Vintage : October, 2023)

Interpretation :

- The highest slope of the ML area is 25⁰ and lowest is 6⁰. The average angle of slope of the mine lease area is about 16⁰.
- As per the Surface cum Geological Plan, Slope Section of the quarry site is provide below :-

Section A-A'	25 ⁰
Section B-B'	21 ⁰
Section C-C'	21 ⁰
Section D-D'	13 ⁰
Section L-L'	6 ⁰
Section L1-L1'	8 ⁰
Section L2-L2'	16 ⁰
Section L3-L3'	17 ⁰
Section L4-L4'	19 ⁰

Digital Elevation Model (DEM) map



Interpretation :

Digital Elevation Model (DEM) for ML area & 500 meters from periphery of ML area is prepared in GIS platform and the Elevations within ML area is falling between 180-200 to 60-80 MSL.



Slope Map

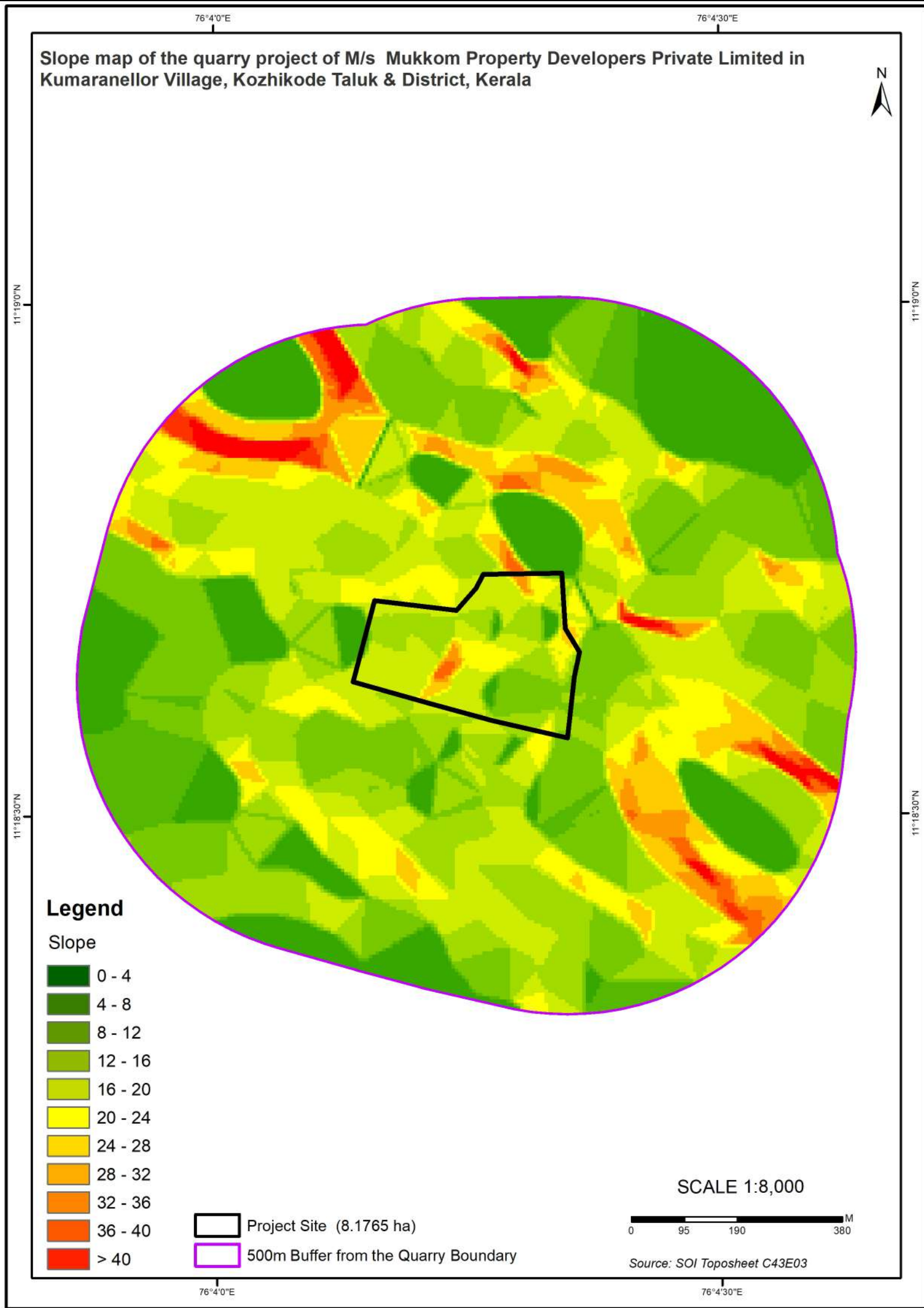


Figure 3.13 – Slope Map of the ML area & surrounding area
(Slope Classification Source :- With the reference of International Institute for Aerospace Survey and Earth Sciences (ITC), Netherlands)
(Vintage : October, 2023)

Interpretation :

ML area falls mostly within 16°-20° and below 16° slope category. Small portion 32°-36° and 36° - 40° slope category.

3.3.2 Water Environment

Water Environment : Protocols for Water Sampling methodology

The sampling methodology and protocols for Water sampling is as per CPCB norms and the methodology description is provided at **Annexure No. 3.4.**

Introduction

Mining & its associated activities use 35 KLD of water for various purposes and also affect the hydrological regime of the area. The water quality of the region is also likely to get affected through runoff and leachate. Therefore, baseline information on ground and surface water regime is very important. Water availability and water quality are the two major aspects to be considered for baseline status of water environment.

Ground Water

Ground water table identification

A survey was conducted near project site to ascertain the ground water status of core zone and buffer zone (located in the immediate vicinity) and information about the existing wells available, depth of well, water level etc. The details of existing wells located in the immediate vicinity is provided at Table 3.6.

The satellite map showing the well located in the immediate vicinity (1 kms.) of project site is provided at Figure 3.14.

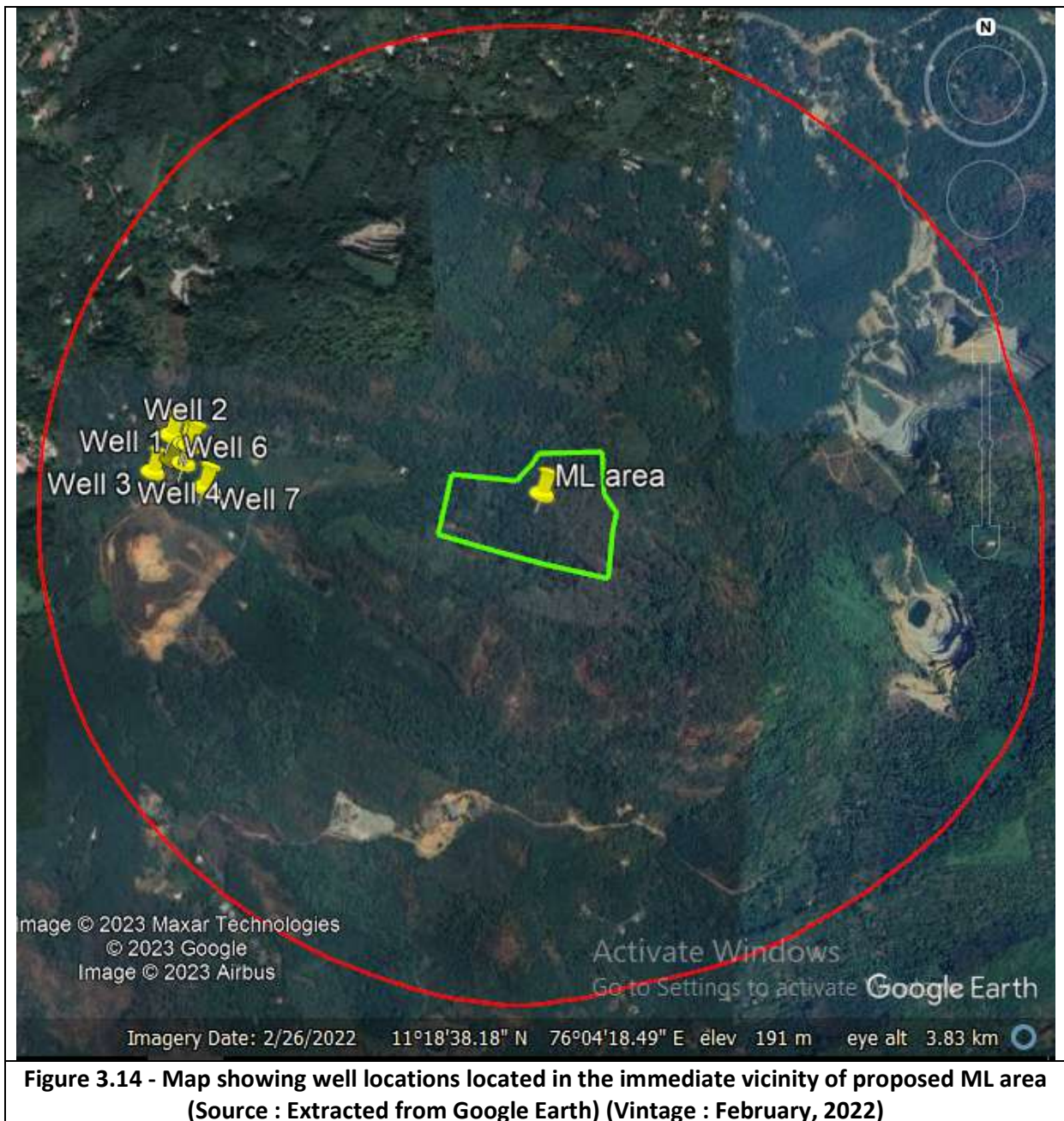


Table 3.6 - Location & details of wells located in the immediate vicinity (1 kms.).

Well No.	Latitude and Longitude	Diameter (in m)	Depth of well from Gr. Level (in m)	Reduced Water Level (MSL)
1	11°18'43.39"N 76° 3'47.30"E	1.80	4.50	46.3
2	11°18'43.29"N 76° 3'47.69"E	1.80	3.10	46.8
3	11°18'41.18"N 76° 3'44.66"E	1.10	3.60	44.8
4	11°18'41.89"N 76° 3'47.19"E	2.60	4.50	44.6
5	11°18'42.14"N 76° 3'46.25"E	1.20	3.30	42.0
6	11°18'44.09"N 76° 3'46.16"E	2.40	5.90	44.7
7	11°18'39.96"N 76° 3'48.82"E	2.60	8.05	44.75

.82"E



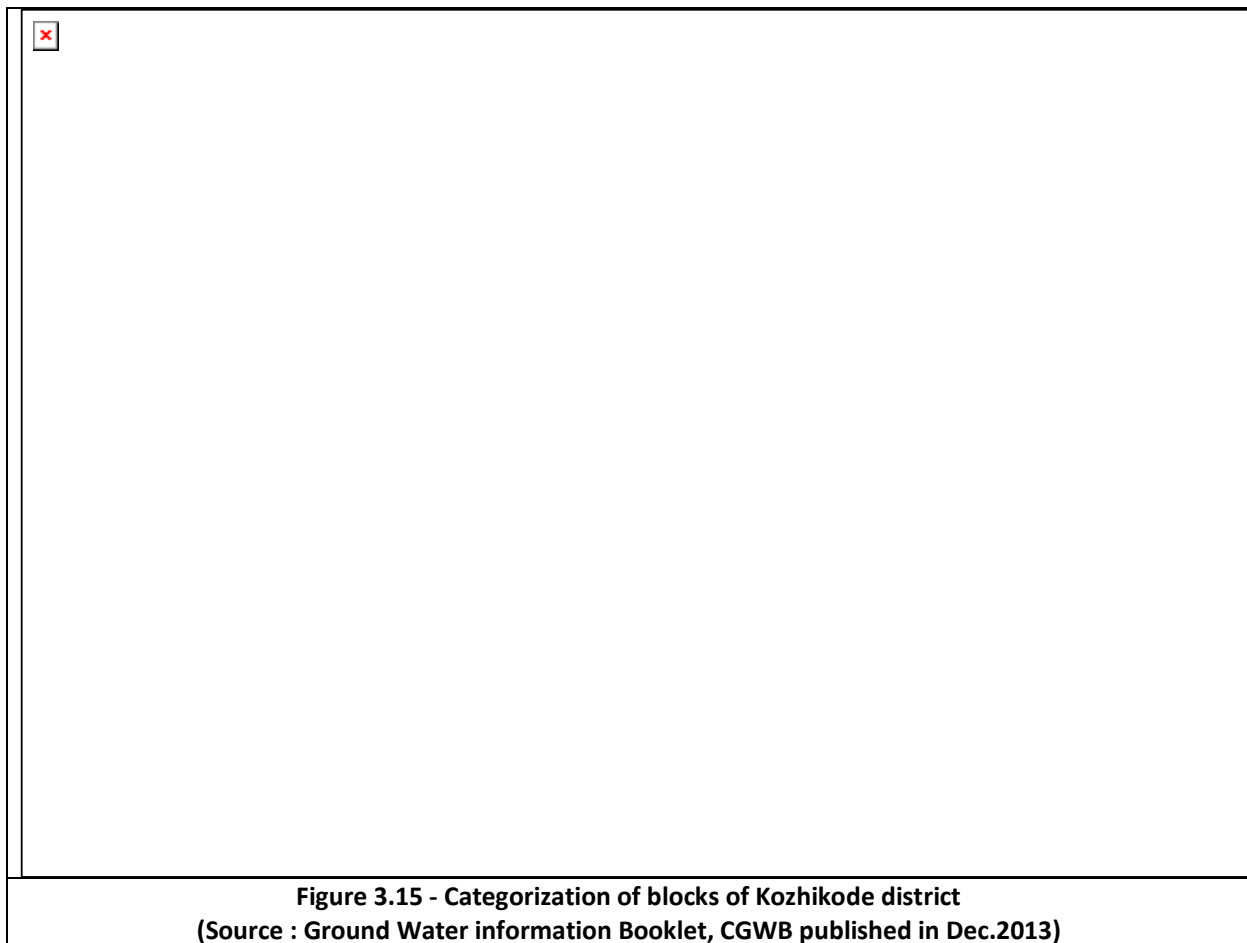


Interpretation - Ground water table identification

The reduced level of the open well located in the immediate vicinity (1 kms.) of the mine lease area is in the range of 42.0 MSL – 44.8 MSL. The reduced level of 44.8 MSL located at Well No. 3 (W3) and there is no intersection of ground water table.

Dynamic Classification of Ground Water status

The stage of groundwater development in the district of Kozhikode during 2009 is 54.61 %, leaving scope for further development. At present about 52.00 MCM of groundwater is used for irrigation out of the net annual groundwater availability of 347.38 MCM. A balance of about 137.45 MCM is left for future irrigation developments. Based on the stage of ground water development and the long term trend of water levels, 2 blocks namely Balusseri and Kunnamangalam have been categorized as 'Semi-Critical' and the remaining 10 blocks are categorized as 'Safe'. The categorization of blocks of Kozhikode district is provided in Figure 3.15.



Interpretation

- **Dynamic Classification**

As per the dynamic classification of ground water extraction, the Core zone is located in *Kunnamangalam* block and which is declared as "Semi Critical" for the abstraction of ground water.



Water Sampling Locations

The water sampling locations (ground water & surface water) are listed in Table 3.7. The water sampling location map is given in Figure 3.16.

Table 3.7 - Description of Water Sampling Location

Station no.	Geo-coordinates of sampling location	Location	Distance & Direction from project area	Environmental Setting
W-1	11°18'44.09"N & 76° 3'46.16"E	Open Well-1 (owned by Mr. Abdul Azeez Nr. Jalanidhi MDWS, Maranchatti)	694 meters (West direction)	Open Well-1 (Ground water)
W-2	11°18'41.18"N & 76° 3'44.66"E	Open Well-2 (owned by Mr. Abdul Azeez, Nr. Juma Masjid, Maranchatti)	710 meter (West direction)	Open Well-2 (Ground water)
W-3	11°18'43.23"N & 76° 3'45.53"E	Thodu Water (Main Outlet Thodu, Nr. Jalanidhi, Maranchatty)	697 meters (West direction)	Surface Water-1
W-4	11°19'44.44"N & 76° 2'59.07"E	Thodu Water (Nr. Mankayam Checkdam)	2.85 kms (NW direction)	Surface Water-2



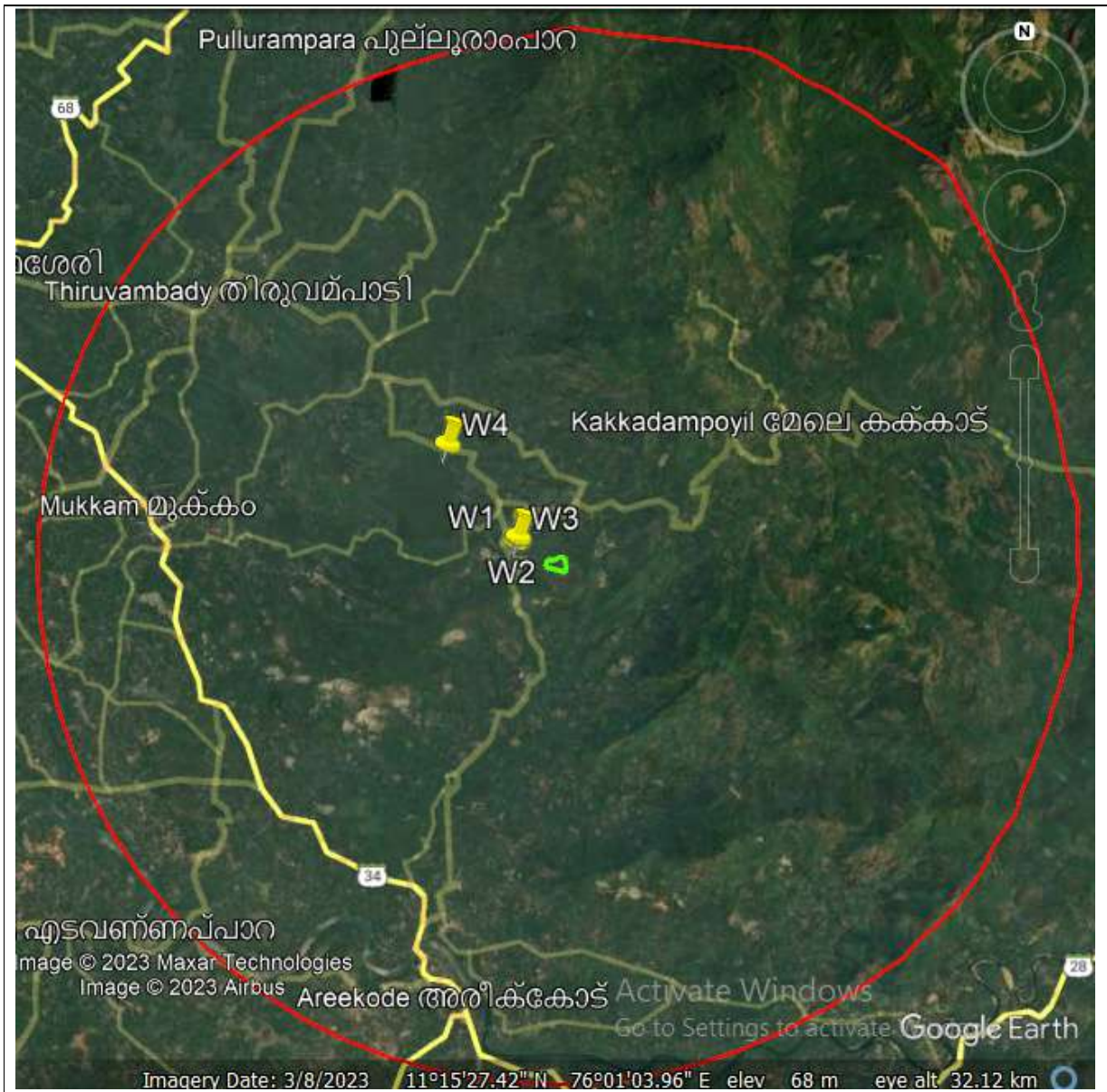


Figure 3.16 - Water Sampling Location Map

Source :- Extracted from the Google earth map (Vintage : March, 2023)



Water sampling results

The water sampling are collected from ground water (open wells) near to project site and surface water from Thodu near Jalanidhi, Maranchatty and near Mankayam Checkdam within the study area. The ground water (open wells) analysis results are given below at Table 3.8.

Also, surface water analysis results are given below at Table 3.9.

Table 3.8 - Analysis of Ground Water (Open well-1 & 2) Results

S N	Parameters	Unit	W-1 (Result)	W-2 (Result)	Requirement as per Acceptable limit (IS 10500-2012)
1.	Turbidity	NTU	0.3	<0.10	Max 1.0
2.	pH	--	5.86	5.66	6.50 – 8.50
3.	Total Dissolved Solids	mg/l	25.4	22.4	Max 500
4.	Total Alkalinity	mg/l	7.92	3.96	Max 200
5.	Total Hardness	mg/l	6.00	6.00	Max 200
6.	Chloride	mg/l	4.03	4.03	Max 250
7.	Sulphate	mg/l	2.58	1.92	Max 200
8.	Nitrate	mg/l	<1.00	<1.00	Max 45
9.	Fluoride	mg/l	<0.10	<0.10	Max 1.0
10.	Magnesium	mg/l	<1.00	<1.00	Max 30
11.	Iron	mg/l	0.39	0.11	Max 1.00
12.	Ammonia as total ammonia -N	mg/l	<0.01	<0.01	Max 0.5
13.	Lead	mg/l	BDL (LOD-0.01)	BDL (LOD-0.01)	Max. 0.01
14.	Copper	mg/l	BDL (LOD-0.016)	BDL (LOD-0.016)	Max 0.05
15.	Cadmium	mg/l	BDL (LOD-0.003)	BDL (LOD-0.003)	Max 0.003
16.	Mercury	mg/l	BDL (LOD-0.001)	BDL (LOD-0.001)	Max 0.001
17.	Zinc	mg/l	BDL (LOD-0.008)	BDL (LOD-0.008)	Max 5.0
18.	Arsenic	mg/l	BDL (LOD-0.001)	BDL (LOD-0.001)	Max 0.01
19.	Chromium	mg/l	BDL (LOD-0.05)	BDL (LOD-0.05)	Max. 0.05
20.	Nickel	mg/l	BDL (LOD-0.02)	BDL (LOD-0.02)	Max 0.02
21.	Dissolved Oxygen	mg/l	6.90	6.90	--
22.	Biochemical Oxygen Demand (3 days at 27°C)	mg/l	<2.00	<2.00	--
23.	Chemical Oxygen Demand	mg/l	<4.00	<4.00	--
Biological parameters					
1.	Total Coliforms	/100ml	Present/100 ml	Present/100 ml	Absent/100 ml
2.	E coli	/100ml	Absent/100 ml	Absent/100 ml	Absent/100 ml



**Table 3.9 - Analysis of Surface Water Results
(Nr. Jalanidhi, Maranchatty & Near Mankayam Checkdam)**

S N	Parameters	Unit	W-3 (Result)	W-4 (Result)	Requirement as per Acceptable limit (IS 10500-2012)
1.	Turbidity	NTU	0.60	16.4	Max 1.0
2.	pH	--	5.89	6.76	6.50 – 8.50
3.	Total Dissolved Solids	mg/l	26.0	35.2	Max 500
4.	Total Alkalinity	mg/l	5.94	11.9	Max 200
5.	Total Hardness	mg/l	6.00	6.00	Max 200
6.	Chloride	mg/l	4.03	4.03	Max 250
7.	Sulphate	mg/l	4.44	8.07	Max 200
8.	Nitrate	mg/l	<1.00	<1.00	Max 45
9.	Fluoride	mg/l	<0.10	<0.10	Max 1.0
10.	Magnesium	mg/l	<1.00	<1.00	Max 30
11.	Iron	mg/l	0.85	3.38	Max 1.00
12.	Ammonia as total ammonia -N	mg/l	<0.01	<0.01	Max 0.5
13.	Lead	mg/l	BDL (LOD-0.01)	BDL (LOD-0.01)	Max. 0.01
14.	Copper	mg/l	BDL (LOD-0.016)	BDL (LOD-0.016)	Max 0.05
15.	Cadmium	mg/l	BDL (LOD-0.003)	BDL (LOD-0.003)	Max 0.003
16.	Mercury	mg/l	BDL (LOD-0.001)	BDL (LOD-0.001)	Max 0.001
17.	Zinc	mg/l	BDL (LOD-0.008)	BDL (LOD-0.008)	Max 5.0
18.	Arsenic	mg/l	BDL (LOD-0.001)	BDL (LOD-0.001)	Max 0.01
19.	Chromium	mg/l	BDL (LOD-0.05)	BDL (LOD-0.05)	Max. 0.05
20.	Nickel	mg/l	BDL (LOD-0.02)	BDL (LOD-0.02)	Max 0.02
21.	Dissolved Oxygen	mg/l	6.20	6.80	--
22.	Biochemical Oxygen Demand (3 days at 27°C)	mg/l	<2.00	<2.00	--
23.	Chemical Oxygen Demand	mg/l	<4.00	<4.00	--
Biological parameters					
1.	Total Coliforms	/100ml	Present/100 ml	Present/100 ml	Absent/100 ml
2.	E coli	/100ml	Absent/100 ml	Absent/100 ml	Absent/100 ml

The analysis reports of water sampling reports collected from Ground water (Open well-1 & 2) & Surface water (Thodu) is provided at **Annexure No. 3.5 & Annexure No.3.6.**



Interpretation of results**Ground Water**

All the parameters of the ground water (Open well water-1 & 2) are within the acceptable limit except parameters of pH level & Total Coliforms. It is suggested that appropriate treatment for pH level adjustment & for total Coliforms would be suggested. Also, regular monitoring is required. If any of the parameter exceed from the standard limits, appropriate treatment would be done before its consumption for drinking purposes.

Surface Water

All the parameters of the surface water (stream water) are within the acceptable limit except pH, turbidity & Total coliform.



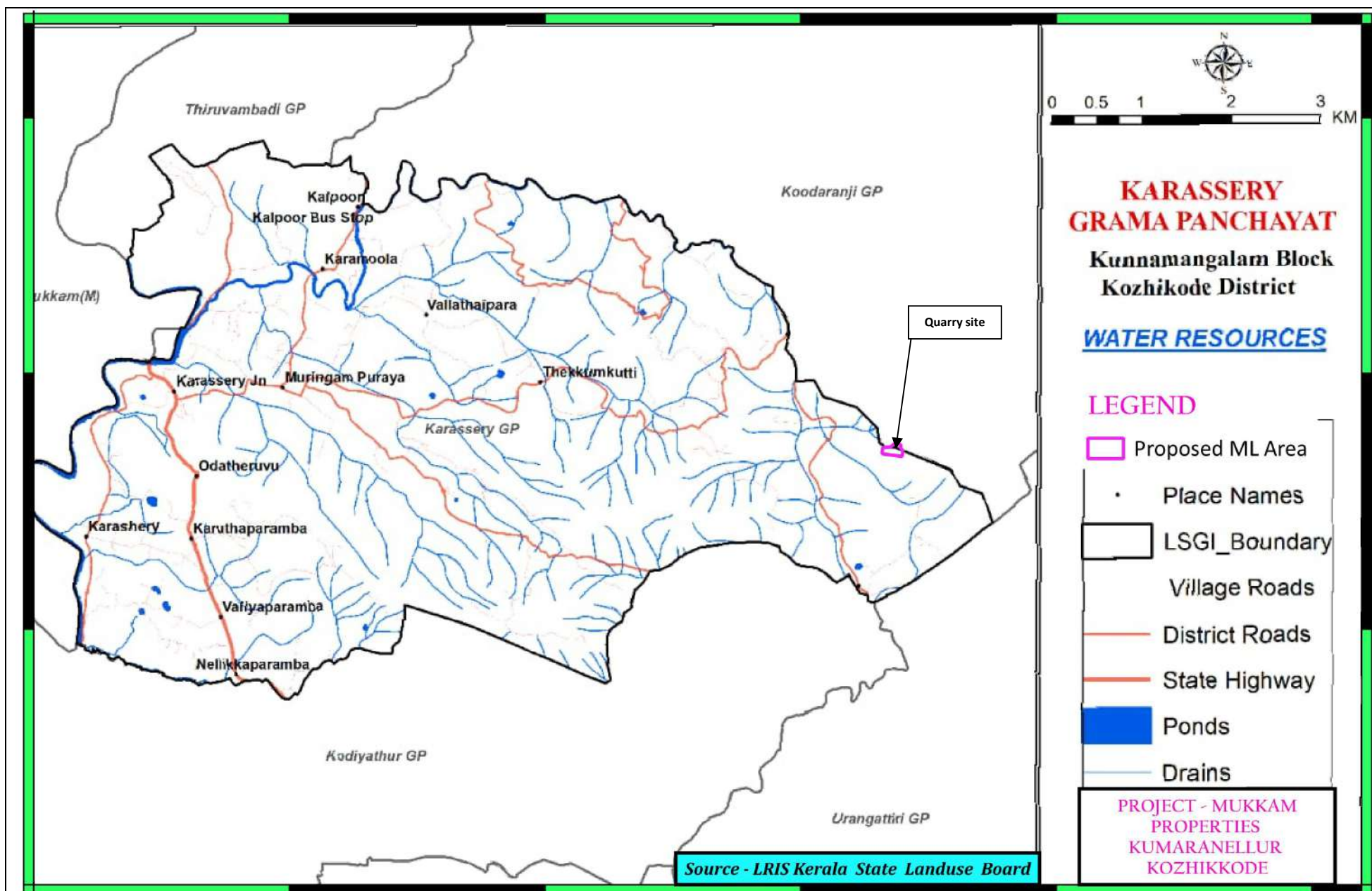


Figure 3.17 – Drainage Map of Karassery Grama Panchayat showing ML area

Source : Web GIS based Land Resource Information System (LRIS) Land Use Board of Kerala (Vintage : October, 2023)

Interpretation:

There is 1st order stream which connects to the 2nd Order and 3rd Order streams located in the north-west direction of the proposed ML area.

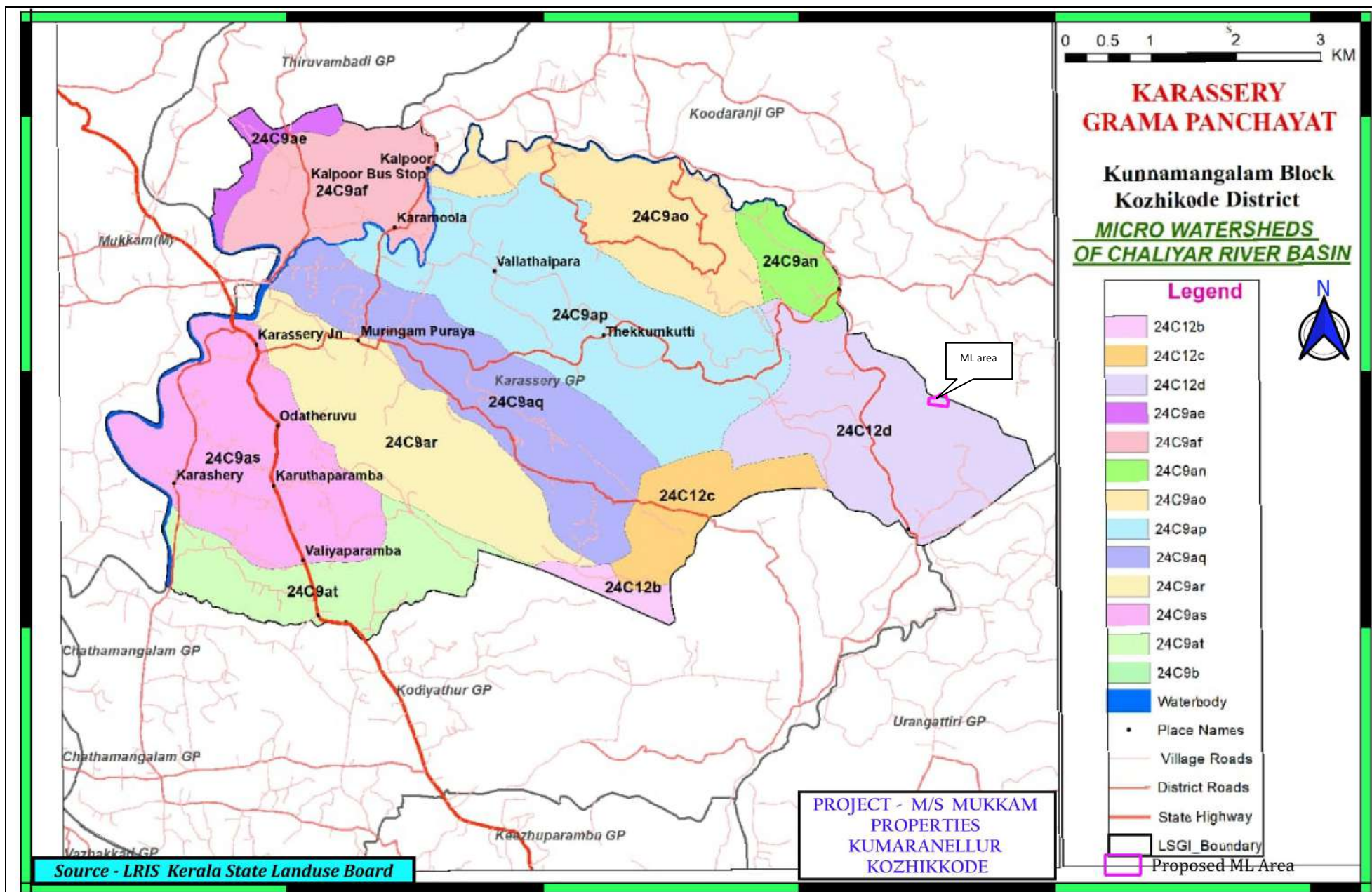


Figure 3.18 – Micro Watershed Map of Karassery Grama Panchayat showing ML area
 Source : Web GIS based Land Resource Information System (LRIS) Land Use Board of Kerala
 (Vintage : October, 2023)

Interpretation :

ML area falling in the Microwatershed 24C12d of Karassery Grama Panchayat.



3.3.3 Noise Environment & Vibration

Noise Environment : Protocols followed for Noise Level monitoring & methodology

The sampling methodology and protocols followed for Ambient Noise Level Monitoring is as per CPCB norm and the methodology description is provided at **Annexure No. 3.7.**

Vibration

Secondary Data :

To determine the zone of influence for blasting operations in granite / stone quarries in the State of Kerala, experimental blasts were conducted in nine representative quarries selected by the Joint Committee formed by Hon'ble National Green Tribunal (PB), New Delhi. The Joint Committee formed in compliance with Hon'ble National Green Tribunal (constituted with scientists, officers from prestigious National level institutions and agencies as members and officer from Central Pollution Control Board (CPCB) as Member Convener) selected nine quarries for the experimental sites to represent the whole state of Kerala and conducted study period of the field investigations was from December 2022 to January, 2023.

Introduction

The noise level monitoring in the study area is carried out at sensitive receptors like School & Temple etc. These locations are also located within the Human settlement (Residential area). The sound level monitoring data is presented below.

The Ambient Noise level locations are listed in Table 3.10 and the map showing the locations is provided Figure 3.19.

Table 3.10 : Ambient Noise Monitoring Locations

Location no.	Geo-coordinates	Name of location	Distance & direction	Remark
N1	11°18'38.61"(N) & 76° 4'17.69"(E)	Project site	Within the site	Core zone
N2	11°18'45.70"(N) & 76° 4'0.87"(E)	Own house of Mukkam properties	About 270 m. (NW direction)	Study area
N3	11°19'14.78"(N) & 76° 3'33.94"E	Near Mary Girl High School, Koodaranhi – Maranchatty Rd, Maranchatty	About 1.5 km (NW direction)	Study area
N4	11°18'36.61"(N) & 76° 3'16.72"(E)	Near IHRD College of Applied Science	About 1.5 km (W direction)	Study area



N5	11°19'10.72"(N) & 76° 4'38.23"(E)	Near Fathimabi Memorial HS School, Koombara	About 1 km (NE direction)	Study area
N6	11°17'46.07"(N) & 76° 4'19.29"(E)	Near Government U P School, Chundathupoyil	About 1.5 km (S direction)	Study area

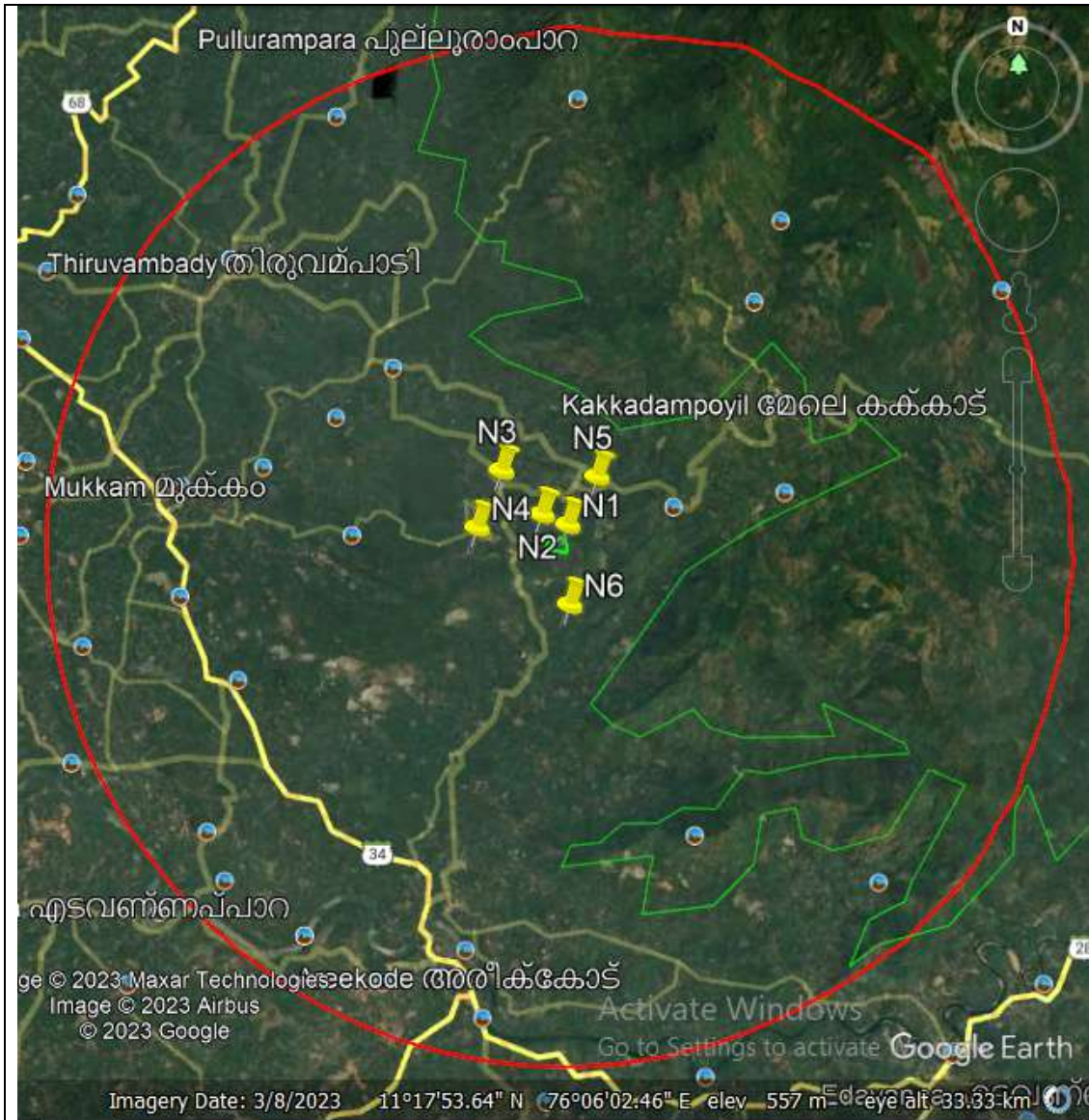


Figure 3.19 - Location of Ambient Noise Level Monitoring Stations
 (Source : Extracted from Google Earth) (Vintage : March, 2023)

Ambient Noise levels results

The ambient Noise level samples were collected in presence of the functional area experts (noise) and analyzed by NABL accredited laboratory, the results are given in Table 3.11.

Table 3.11 : Ambient Noise Monitoring Results

S. N.	Location	Environmental Setting*	Ambient Sound Level (Leq)	Remarks
1.	N-1	Project site	49.3	Industrial Area
2.	N-2	Own house of Mukkam properties	48.9	Residential area
3.	N-3	Near Mary Girl High School, Koodaranhi – Maranchatty Rd, Maranchatty	47.7	Silence Zone
4.	N-4	Near IHRD College of Applied Science	47.9	Silence Zone
5.	N-5	Near Fathimabi Memorial HS School, Koombara	48.4	Silence Zone
6.	N-6	Near Government U P School, Chundathupoyil	48.0	Silence Zone

***Industrial Area / Commercial Area / Residential area / Silence Zone**

The analysis report of all ambient noise level stations is provided at **Annexure No. 3.8.**

Table 3.12 : National Ambient Noise Level Standards

Area Code	Category of Area	Limits in dB (A) Leq	
		Day time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential area	55	45
D	Silence Zone	50	40

(Source :- The Principal Rules (the Noise Pollution (Regulation and Control) Rules, 2000) were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986).



Interpretations

Interpretation w.r.t. National Standards

The analyzed results of Noise levels are given in the above table and it can be observed from the result that the noise values at all monitoring stations are well within the National Standards.

Interpretation w.r.t. project surroundings

The analyzed values of the parameters w.r.t. the project site and the surroundings are compared. There is not much variation on values of the ambient noise levels of the core zone and in the study area of the surroundings.

Vibration

In the specific ToR issued by SEIAA, Kerala, one of the item for study is as follows :-

“Vibration studies to evaluate the zone of influence and impact of blasting on the neighbourhood as suggested in para (e) of OM No Z -11013/57/2014-IA.II (M) dated 29-10-2014 of MOEF&CC”.

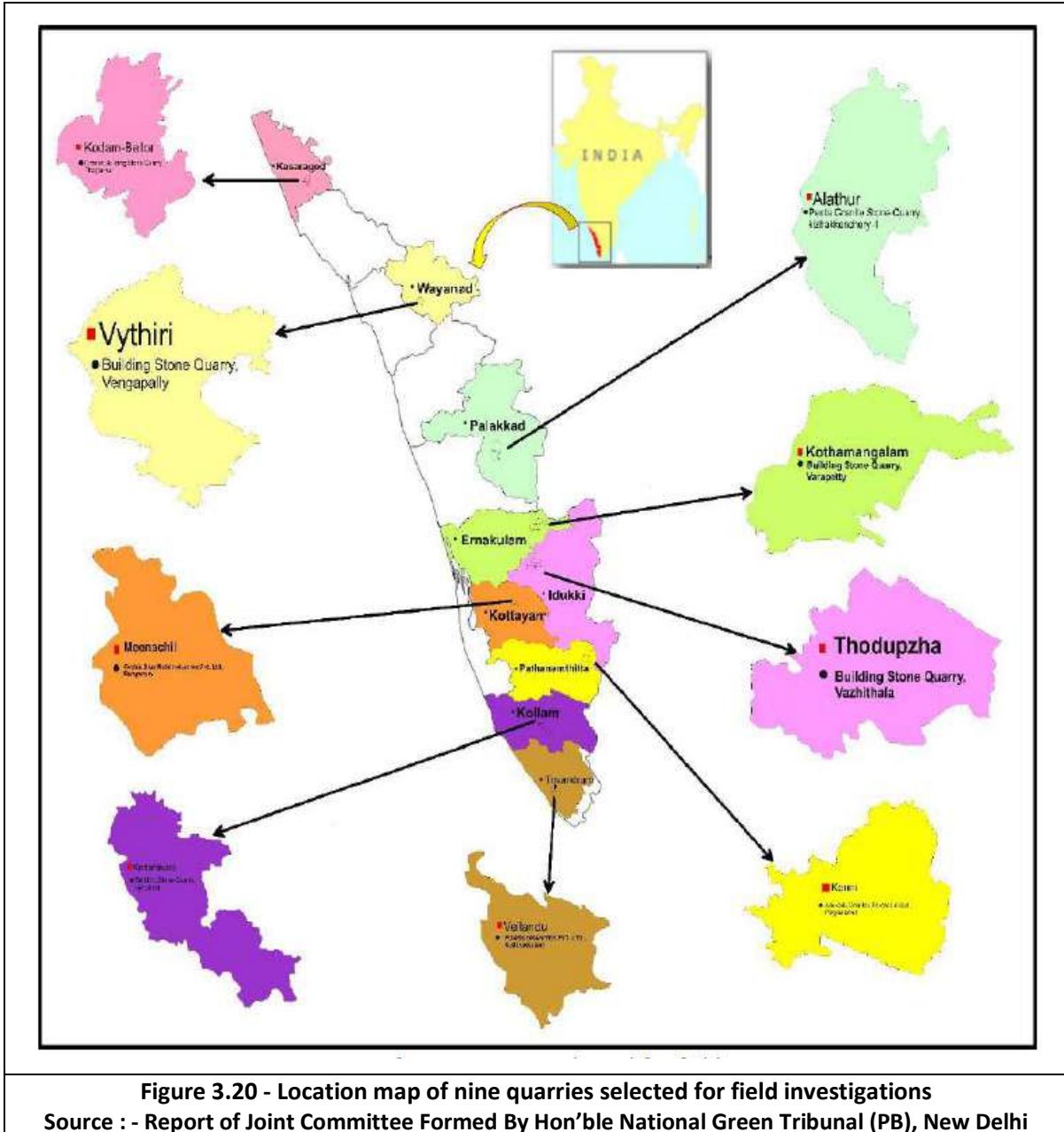
The proposed project is a new quarry project and there is no quarrying operations / blasting operations currently at site. Since the quarry operations can be commenced only after obtaining Environmental Clearance and all other statutory approvals, blasting cannot be carried out now for vibration studies. The PP approach Mining & Geology Department for permission to conduct blasting for study purposes but the Department have no provision to permit such pre-mining blasting. Therefore, the PP can not submit primary data on vibration studies to evaluate the zone of influence. Further, it may kindly be noted that there are no built-structures located within 200 meters from the periphery of the proposed mine lease area. In the above referred O.M. dt. 29-10-2014, the minimum set back distance prescribed is 50 meters only. In view of the inability of the PP to produce pre-mining vibration studies, the PP relied upon secondary data to determine the zone of influence due to blasting.

REPORT OF JOINT COMMITTEE FORMED BY HON’BLE NATIONAL GREEN TRIBUNAL (PB), NEW DELHI ON BLASTING OPERATIONS IN GRANITE / STONE QUARRIES IN THE STATE OF KERALA.

To determine the zone of influence for blasting operations in granite / stone quarries in the State of Kerala, experimental blasts were conducted in nine representative quarries (Figure 3.20) selected by the Joint Committee formed by Hon’ble National Green Tribunal (PB),



New Delhi. The Joint Committee formed in compliance with Hon'ble National Green Tribunal (constituted with scientists, officers from prestigious National level institutions and agencies as members and officer from Central Pollution Control Board (CPCB) as Member Convener) selected nine quarries for the experimental sites to represent the whole state of Kerala and conducted study period of the field investigations was from December 2022 to January, 2023.



The report dated 28.02.2023 of Joint Committee is stated as “Out of the ground vibration data recorded from the 91 blasts, ground vibration data exceeded the permissible limit of 5 mm/s only in five cases within a zone **of 50 – 100 m.**” This secondary data is used for the instant proposal. After the commencement of mining operations, vibration study will be carried out by the PP either through any reputed agency within one month and report will be submitted to the regulatory authority.

Table 3.13 : The salient recommendations of the Joint Committee report was accepted by the Hon’ble NGT with regard to vibration in a quarry is quoted below:-

Parameter	Distance (m)				Remarks/ observation
	50	100	200	500	
Ground vibration					Out of the ground vibration data recorded from the 91 blasts, ground vibration data exceeded the permissible limit of 5 mm/s only in five cases within a zone of 50-100 m.

The tables showing the vibration study details of mining project Minimum and Maximum Values of PPV and AOP recorded during experimental trials at different stone quarries of Kerala by the expert committee are provided below table.

Table 3.14 : Minimum and Maximum Values of PPV and AOP recorded during experimental trials at different stone quarries of Kerala.

Location of Quarry (District)	PPV (mm/s)				AOP [dB(L)]				PPV recorded below 50 m	
	Minimum		Maximum		Minimum		Maximum		m	mm/s
	m	mm/s	m	mm/s	m	dB(L)	m	dB(L)		
Pathanamthitta	250	0.554	50	4.115	250	91.5	89	110.6	46	3.29
Kollam	100	0.558	50	2.349	75	109.2	50	126.2	48	2.28
Trivandrum	250	0.524	50	8.21	183	97.5	45	124.8	45	6.85
Ernakulam	296	0.539	51	5.882	275	91.48	51	123.4	41	4.36
Idukki	354	0.651	75	4.229	320	91.48	42	116.6	42	3.50
Kottayam	241	0.813	28	10.42	200	93.98	28	126.8	28	10.42
Palakkad	205	0.751	55	2.514	205	91.48	92	112.6	35	4.474
Wayanad	197	0.554	50	1.849	197	97.5	145	116.9	40	2.865
Kasaragod	112	0.524	50	3.053	75	97.5	79	128.6	35	4.664



Suggestions and recommendations by Expert committee:

As per the assessment study the influence zone of ground vibration is 50-100 m from the blasting zone. The maximum value of Air Over Pressure (AOP) recorded was at a distance of 100 m from the blasting face. The fly rock ejections were noticed in two instances and it were less than 25 m from the blast zone. As per the assessment of noise, the influence zone is up to 200 m and it was observed that extraneous noise from other sources spiked the readings at some of the 200 m stations. Hence, a distance of 150 m can be considered as the noise influence zone from the blasting zone. The particulate matter emissions were obvious up to a distance of 100 m from the blasting zone and hence it can be considered as the influence zone of dust emissions.

(Study conducted by : “Report of the Joint Committee Constituted by Honourable National Green Tribunal”).

Vibration level of instant proposal determined through empirical formula

Table 3.15 : Calculation of Vibration level due to blasting by using explosives from the proposed quarry

Annual Production	3,00,000 MT
Daily Production	1,000 MT (@300 working days in a year)
No. of blasts in a day	3 Time (11.00 am, 02.00 pm & 4.00 pm)
Production per blast	1,000 / 3 = 333.33 MT / blast say 334 MT/blast
Rocks broken per hole	14.0625 MT say 14 MT / blast (Average Production per hole of depth 1.5 m to 2.5 m of 32 mm dia).
No. of holes	334 MT / 14 MT = 23.85 Holes say 24 Holes / Blast
Quantity of explosive per blast	500 gm per hole
Total quantity of explosives	24 holes x 500 gm = 12 kg/blast
Distance to nearest habitation	About 270 meters (near BP 1, NW direction)
Vibration level	1.6899 mm/sec

Q = Quantity of explosive per blast = 12 kg

D = Distance to the nearest building = 270 meters

V = 1.6899 mm/sec



Table 3.16 : Permissible Peak Particle Velocity (PPV in mm/s) at the foundation level of structures in mining areas

Type of Structure	Dominant Excitation Frequency, Hz		
	<8 Hz	8-25 Hz	>25 Hz
(A) Building / structures not belong to owner			
(i) Domestic houses / structures (Kuchha, brick & cement)	5	10	15
(ii) Industrial Buildings (RCC & Framed Structures)	10	20	25
(iii) Objects of historical Importance & sensitive Structures	2	5	10
(B) Buildings belonging to owner with limited span of life			
(i) Domestic houses / structures (Kuchha, brick & cement)	10	15	25
(ii) Industrial buildings (RCC & framed structures)	15	25	50

Interpretation:

From the various vibration studies carried out by Nationally reputed agencies as reported above, it is inferred that blasting operations can be conducted in the stone quarry using 32 mm diameter blast holes drilled with hand held jackhammer to a depth of 5 ft (1.5 m), each hole charged with a maximum of 500 gms of explosive, the PPV (peak particle velocity) (measure of vibration level) due to the blasting at the nearest structure at 270 meters. Further, the vibration level (PPV) value determined through empirical formula at 270 meter structure is 1.6899 mm/sec. whereas the safe value prescribed by Director General of Mines Safety (DGMS) is 15 mm/sec. and therefore the vibration level of the instant proposal is well within the prescribed limits.



3.3.4 Ecological Environment

Ecological Environment : Methodology for Floral & Faunal Assessment

Floral Assessment:

Floral Assessment - Core Zone

The Qualitative floral Assessment was done by quadrat method. The quadrat is a square sample area of varying size marked-off in the plant community for the purpose of detailed study. Generally a number of quadrats are studied to acquire reasonably faithful data to realise different analytic and synthetic characters of the plant community. The quadrat method includes lying down of a square sample plot of suitable size randomly for detailed analysis of vegetation. It may be a single sample plot or may be divided into several subplots. In the present study, entire project area was sampled for the analysis of tree diversity. Quadrats of 5m x 5m and 1m x 1m were used for shrubs and herbaceous communities respectively. Belt Transect method is used for buffer zone floral study and secondary data were also used for the preparation of Buffer Zone floral Diversity.

The plant species were identified with the help of secondary sources [Eg. DVD-Flowering plants of Kerala by Kerala Forest Research Institute (KFRI)]. Besides the collection of plant species, information was also collected with vernacular names of plant species made by local inhabitants and from the DVD from KFRI. The other relevant data on biodiversity, economically important plant species and medicinal plant, rare, endangered, threatened species in the study area have been collected during site visit and from different secondary sources.

Floral Assessment – 10 km radius Buffer Zone

In the 10 km radius Buffer zone, the Qualitative floral Assessment was done by Belt Transect method for floral assessment. Secondary data are also used for the preparation of the biodiversity report of the buffer zone. In this process the whole study area was divided into different sections to get the maximum diversity of plant species. The sampling sites were selected based on land use pattern, topography and floristic composition of the study area. The Qualitative Assessment was done by transect method covering the entire area in to appropriate Grids. From the total grids, appropriate number of grids were selected at random for transect analysis.



Faunal Assessment:

- **Birds, Butterflies, Odonates:** Line Transect & Point count method
- **Mammals:** Line Transect method, Consultation with local people
- **Amphibians:** Transect and Patch Sampling
- **Spiders:** Searching and Direct Observations

The analysis of fauna was done as per the above discussed methodology for each type of fauna. Each fauna was compared with IUCN status to identify whether it is of least concern or near threatened or vulnerable.

Secondary Data :

1. DVD-Flowering plants of Kerala by Kerala Forest Research Institute (KFRI)
2. IUCN status list

Introduction

The mining activity affects the terrestrial ecological environment. Therefore, a primary survey on the ecological assessment of the site (flora and fauna) is required to be carried out.

ECOLOGICAL ASSESSMENT – MINE LEASE AREA (CORE ZONE)

Plate 3.4 – General View of the proposed quarry
(Source : Photos taken during the Field visit by the FAE)



Photo-1 : General View of the proposed quarry





Photo-2 : General View of the proposed quarry



Photo-3 : General View of the proposed quarry



Photo-4 : General View of the proposed quarry



Photo-5 : General View of the proposed quarry

Findings

Flora

Analysis of the flora revealed that there are 124 plant species falling under 54 plant families. Angiosperms forms 119 species with 26 species of trees including saplings, 27 species of shrubs, 45 species of herbs and 21 species of climbers. There are 5 Pteridophytes (ferns) falling under four families.

As per the ecological assessment, there are 159 tree species in 7.5 m. buffer area and 1,643 trees in mineable area existing within the core zone (total 1,802 say 1,800 trees).

The Site has 124 species of plants. It consists of:

Trees	:	20 species
Tree saplings	:	18 species
Shrubs	:	27 species
Herbs	:	45 species
Climbers	:	21 species
Ferns	:	5 species

Fauna

The following lists of faunal elements were observed from the site:

Mammals	:	15 species
Reptiles	:	10 species
Birds	:	35 species
Amphibians	:	6 species
Butterflies	:	37 species
Odonates	:	17 species
Spiders	:	18 species

Interpretation of Ecological Assessment

Flora

- The land use of ML area is cultivated with *Rubber* plantation and hence there is change in the land use from the original land use.
- Most of the floral species with habitat of moist deciduous forest.
- There are alien invasive species within the site and identified alien species are given below:-



Table 3.17 – Details of Invasive Species found in the ML area

S.N.	Botanical Name	Common Name	Type
1	<i>Lantana camara</i> L.	Kongini	Shrubs
2	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Communist-pacha	Shrubs
3	<i>Hyptis suaveolens</i> (L.) Poit.	Nattapoochedi	Shrubs
4	<i>Colocasia esculenta</i> (L.) Schott	Chembu	Herb
5	<i>Senna tora</i> (L.) Roxb.	Thakara	Herb
6	<i>Pueraria phaseoloides</i> (Roxb.) Benth.	Thotta-payar	Climber
7	<i>Mikania micrantha</i> Kunth	Vayara	Climber

- The most dominant plant families are Leguminosae and Euphorbiaceae with 9 plant species each followed by Malvaceae, Compositae, Rubiaceae and Moraceae.
- There is no Rare, Endangered or Threatened (RET) Species found in the proposed site area.
- There is forest boundary outside the ML area at about 101 meters located in the east direction & south direction.
- Endemic species (with the propagation process) identified during ecological assessment from the ML area is given below table :-

Table 3.18 : List of Endemic plant species observed from the proposed mining area and its Natural/Commercial Propagation procedures

SN	Botanical Name	Endemism	Propagation Methods	Remarks
1	<i>Tabernaemontana alternifolia</i> L.	Endemic to the Western Ghats	Seed propagation, cuttings and divisions of old rootstocks	Tree sampling
2	<i>Artocarpus hirsutus</i> Lam.	Endemic to Southern Western Ghats	Seed propagation, grafting	Tree sampling
3	<i>Naregamia alata</i>	Endemic to Peninsular India	Seed propagation	Herbs
4	<i>Torenia bicolor</i> Dalz.	Endemic to Western	Seed propagation	Herbs
5	<i>Calamus hookerianus</i>	Endemic to Western Ghats	Seed propagation	Climber

Interpretation of Faunal species in the ML area

- Regarding the conservation status of the fauna, none of the animal species identified from the site belongs to the threatened categories identified by the International Union for Conservation of the Nature and Natural Resources (IUCN).
- The Mammals Indian Porcupine, Bonnet Macaque, Common mangoose are in Schedule-I Category.
- The Mammals Indian Porcupine, Bonnet Macaque, Common mangoose and Indian Wild Boar are commonly sighted in the project area and surroundings.



- Most of them are common and widely distributed and the range of occurrence extended to wide geographical area.
- One faunal species viz. *Southern Birdwing* is found to be Endemic to Western Ghats.

ECOLOGICAL ASSESSMENT – STUDY AREA WITHIN 10 KMS OUTSIDE ML AREA

Interpretation of Ecological & biodiversity status of study areas

Flora

Major land use of the area identified

- 1) Mixed Crop System
- 2) Rubber plantation
- 3) River/Stream/Canals (Iravazhinjipuzha, Chaliyar)
- 4) Semi-Evergreen Forest
- 5) Deciduous Forest
- 6) Riparian Forest
- 7) Grassland
- 8) Arecanut Fields
- 9) Cocunut Fields
- 10) Bananana Fields
- 11) Barren Rocky Area
- 12) Urban land

The Site has 603 species of plants. It consists of:

Trees	:	201 species
Shrubs	:	112 species
Herbs	:	188 species
Climbers	:	86 species
Ferns	:	16 species

Following floral endemic species (trees, shrubs, herbs, climbers) were observed in the buffer zone during survey conducted and is provided in the Table 3.19.

**Table 3.19 - List of floral endemic species observed from the study area
(trees, shrubs, herbs, climbers)**

List of Endemic trees observed in the buffer zone						
SN	Botanical Name	Common Name	Family	Habitat	Distribution	Status
1.	<i>Diospyros candolleana</i>	Kari, Karimaram	Ebenaceae	Evergreen, semi-evergreen and moist deciduous forests	Peninsular India	Endemic to Peninsular India
2.	<i>Litsea</i>		Lauraceae	Evergreen and	Southern	Endemic to the



	<i>quinqueflora</i> (Dennst.) Suresh.			deciduous forests	Western Ghats	Western Ghats
3.	<i>Terminalia paniculata</i> Roth	Maruth	Combretacea e	Moist and dry deciduous forests, also in the plains	Peninsul ar India	Endemic to Peninsular India
4.	<i>Vateria indica</i> L.	Velutta Kunturukka m/Vellapayi n	Dipterocarpac eae	Evergreen and semi-evergreen forests, also in the plains	Western Ghats	Endemic to the Western Ghats
5.	<i>Baccaurea courtallensis</i>	Mootikaya, Mootilpazh am,	Phyllanthacea e	Evergreen and semi-evergreen forests	Peninsul ar India	Endemic to Peninsular India
6.	<i>Artocarpus hirsutus</i> Lam.	Anjili	Moraceae	Semi-evergreen and moist deciduous forests, also in the plains	Southern Western Ghats	Endemic to the Western Ghats
7.	<i>Tabernaemont ana alternifolia</i> L.	Kunnanpala	Apocynaceae	Along margin of the evergreen forests and common in moist deciduous forest, up to 850 m.	Western Ghats	Endemic to the Western Ghats
8.	<i>Garcinia wightii</i>	Aattukaruka	Clusiaceae	Riverine forests	Southern Western Ghats	Endemic to Southern Western Ghats
9.	<i>Dysoxylum malabaricum</i>	Akil, Purippa	Meliaceae	Evergreen forests	Southern Western Ghats	Endemic to Southern Western Ghats
10.	<i>Memecylon malabaricum</i> Cogn.	Kaikka- thetti,Koova chekki	Melastomata ceae	Semi-evergreen forest,also in the plains	Western Ghats	Endemic to Southern Western Ghats
11.	<i>Holigarna grahamii</i>	Cheru	Anacardiacea e	Evergreen forests	Western Ghats	Endemic to Western Ghats
12.	<i>Humboldtia vahliana</i>	Kurappunna , Korathi	Fabaceae	Riverbanks	Southern Western Ghats	Endemic to Southern Western Ghats
13.	<i>Cinnamomum malabratrum</i> (Burm.f.) J.Presl.	Idana	Lauraceae	Evergreen and semi-evergreen forests, also in the plains	Southern Western Ghats	Endemic to Southern Western Ghats
14.	<i>Lagerstroemia</i>	Vellilavu,	Lythraceae	Moist	Western	Endemic to



	<i>microcarpa</i>	Venthekku		deciduous forests	Ghats	Western Ghats
15.	<i>Xanthophyllum arnottianum</i>	Mottal	Polygalaceae	Evergreen and semi evergreen forests	Western Ghats	Endemic to Western Ghats
16.	<i>Ochreinauclea missionis</i>	Aattuvanchi	Rubiaceae	Riverine forests	Southern Western Ghats	Endemic to Southern Western Ghats
17.	<i>Calophyllum calaba</i>	Aattupunna,	Calophyllaceae	Evergreen and semi evergreen forests	Western Ghats	Endemic to Western Ghats
18.	<i>Dysoxylum beddomei</i>	Akil, Adanta	Meliaceae	Evergreen forests	Southern Western Ghats	Endemic to the southern Western Ghats
19.	<i>Hydnocarpus pentandra</i> (Buch.-Ham.) Oken	Marotti	Flacourtiaceae	Semi-evergreen and moist deciduous forests, also in the plains	Western Ghats	Endemic to the Western Ghats-very common in South and Central Sahyadris.

List of endemic shrubs observed in the Study area

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Status
1.	<i>Psychotria flavida</i> Talbot.	South Indian Wild Coffee	Rubiaceae	Evergreen forests and sacred groves	Southern Western Ghats	Endemic to Southern Western Ghats
2.	<i>Osbeckia truncata</i> D. Don ex Wt. & Arn.		Melastomataceae	Moist deciduous forests and grasslands	Western Ghats	Endemic to Southern Western Ghats
3.	<i>Ochlandra travancorica</i>	Eetta, Karetta,	Poaceae	Evergreen and semi evergreen forests	Western Ghats	Endemic to Western Ghats

List of endemic Herbs observed in the Study area

S N	Botanical Name	Common Name	Family	Habitat	Distribution	Status
1.	<i>Anaphyllum wightii</i>	Keerikkizhangu	Araceae	Evergreen and semi evergreen forests	Southern Western Ghats	Endemic to Southern Western Ghats
2.	<i>Lagenandra toxicaria</i>	Neerkizhang u	Araceae	Stream banks	Western Ghats	Endemic to Western Ghats
3.	<i>Globba</i>	Kolachanna	Zingibera	Moist	Peninsular	Endemic to



	<i>sessiliflora</i>		ceae	deciduous forests	India	Peninsular India
4.	<i>Naregamia alata</i> Wight & Arn.	Nilanaragam	Meliaceae	Moist deciduous forests, also in the plains	Peninsular India	Endemic Peninsular India
5.	<i>Oldenlandia corymbosa</i> L.		Rubiaceae	Lateritic slopes	Southern Western Ghats (Kerala)	Endemic to Southern Western Ghats
6.	<i>Impatiens maculata</i>		Balsaminaceae	Stream banks	Southern Western Ghats	Endemic to Southern Western Ghats
7.	<i>Torenia bicolor</i> Dalz.	Kakkapoovu	Scrophulariaceae	Marshy areas	Western Ghats	Endemic to Western Ghats
8.	<i>Begonia crenata</i>			Stream banks	Western Ghats	Endemic to Western Ghats

List of Endemic Climbers observed in the Study area						
SN	Botanical Name	Common Name	Family	Habitat	Distribution	Status
1.	<i>Calamus travancoricus</i>	Vallichooral		Evergreen forests	Southern Western Ghats	Endemic to Southern Western Ghats
2.	<i>Grewia umbellifera</i>	Bhasmavalli	Malvaceae	Evergreen forests	Western Ghats	Endemic to Western Ghats
3.	<i>Bauhinia phoenicea</i>	Vallimandar am	Fabaceae	Evergreen and semi evergreen forests	Western Ghats	Endemic to Western Ghats
4.	<i>Salacia fruticosa</i> Wall.	Ponkarandi/ Eakanayakam	Hippocrateaceae	Evergreen and semi-evergreen forests, also in the sacred groves and plains	Western Ghats	Endemic to Southern Western Ghats
5.	<i>Piper galeatum</i>		Piperaceae	Semi evergreen and evergreen forests	Southern Western Ghats	Endemic to Southern Western Ghats



Interpretation of Fauna in the Study area

Following Endemic Bird species are reported from the buffer area :-

SN	Scientific Name	Common Name	Family	IUCN Status	Remarks
1	<i>Gallus sonneratii</i>	Grey Junglefowl	Phasianidae	Least Concern	Endemic
2	<i>Leptocoma minima</i>	Crimson-backed Sunbird	Nectariniidae	Least Concern	Endemic
3	<i>Galloperdix lunulata</i>	Painted Spurfowl	Phasianidae	Least Concern	Endemic

There is following butterfly species are reported as endemic species in the buffer area.

1. Southern Birdwing (*Troides minos* Cramer) - Endemic to W. Ghats

Most of other species are common and widely distributed and the range of occurrence extended to wide geographical area.

The detailed Ecological Assessment Study Report carried out for the core zone and the buffer zone is provided at **Annexure No. 3.9.**



3.3.5 Socio Economic Environment

Socio Economic Environment – Methodology adopted

To conduct the study, primary and secondary data were used.

Primary Data : Stake holder consultation, unstructured interview, transect walk, and telephonic survey.

Secondary data : Yearly project document (Padhadhi rekha) of the Panchayat, census data 2011, website of Kozhikode District and Department of Panchayat, Data from Krishi bhavan and Primary Health Centre.

District Overview

Kozhikode District was the capital of the erstwhile kingdom of the Zamorins and a renowned commercial center. Today Kozhikode is one of the best cities in Kerala. Endowed with lush green country sides, serene beaches, historic sites, wildlife sanctuaries, rivers, and hills. According to data compiled by economics research firm Indicus Analytics in 2009 on residences, earnings and investments, Kozhikode was ranked the second-best city in India to live in. There are two revenue divisions in Kerala, Kozhikode and Vada kara. The name of 4 Taluks in the district is as follows Kozhikode, Koyilandi, Vada kara and Thamarassery and there are 118 Villages under this 4 Taluks. There is one Municipal Corporation, 7 Municipalities, 12 Block Panchayats, 70 Grama Panchayats as Local Self Government.

Local over view – Karassery Grama Panchayat

The Karassery Grama Panchayat is having 36.9 sq. km of Geographical area which is divided in to 18 wards. Small scale industries and agriculture activities are the main income generation activities in the Grama Pacnhayat. The main income generation activities other than agriculture is crusher, mining. There are three villages included in the Grama panchayat. There are 78 institutions in the Panchayat which are contributing to Grama Panchayat as profession tax.

Various Govt. offices in local level

The main offices under the Grama Panchayat is listed below in table 3.20.

Table 3.20 : Main offices under the Grama Panchayat

Sl. No	Name of Offices
01	Agriculture office
03	Ayurvedic Dispensary
04	Homoeo Dispensary
05	Unani Dispensary



06	Department of Engineering
07	Veterinary dispensary
08	ICDS Office
09	Village offices
10	Village Extension Office
11	Govt. Schools
12	Dairy Extension office

Demography

The name of Grama Panchayat comes in the 10 km periphery of the project site is listed below:-

Table 3.21 : Name of Local Self Government & villages in 10 km periphery of Project site

Sr. No.	Local Self Government (LSG)	Name of village
1	Karassery (Full)	Kakkad, Kumaranellur and Kodyathoor
2	Thiruvambadi (Major)	Thiruvambadi
3	Koodaranhi (Major)	Koodaranhi
4	Chungathara (Small) Malappuram	Erumamunda, Chungathara
5	Chaliyar (Small) Malappuram	Akambadam, Kurumbalangodu, Pullipadam
6	Mampad (Small) Malappuram	Mampad, Pullippadam, Wandoor.
7	Urangattiri (Major) Malappuram	Urangattiri, Vettelappara
8	Edavanna (Small) Malappuram	Edavanna, Perakamanna
9	Kavanuur (Small) Malappuram	Kavanur
10	Areecode (Part) Malappuram	Areecode
11	Cheekode (Part) Malappuram	Cheekode, Muthuvallor
12	Keezhuparamba (Full) Malappuram	Keezhuparamba
13	Vazhakkad (Part) Malappuram	Vazhakkad
14	Kodiyathur (Full)	Kodiyathur & Kakkad
15	Mavoor (Small)	Mavoor
16	Chathamangalam (Part)	Poolakkode, Chathamangalam
17	Mukkom (Major)	Mukkom
18	Kodanchery (Small)	Koodathai, Kodenchery, Nellipoyil

Source:- Website of Department of Panchayat, Govt. of Kerala



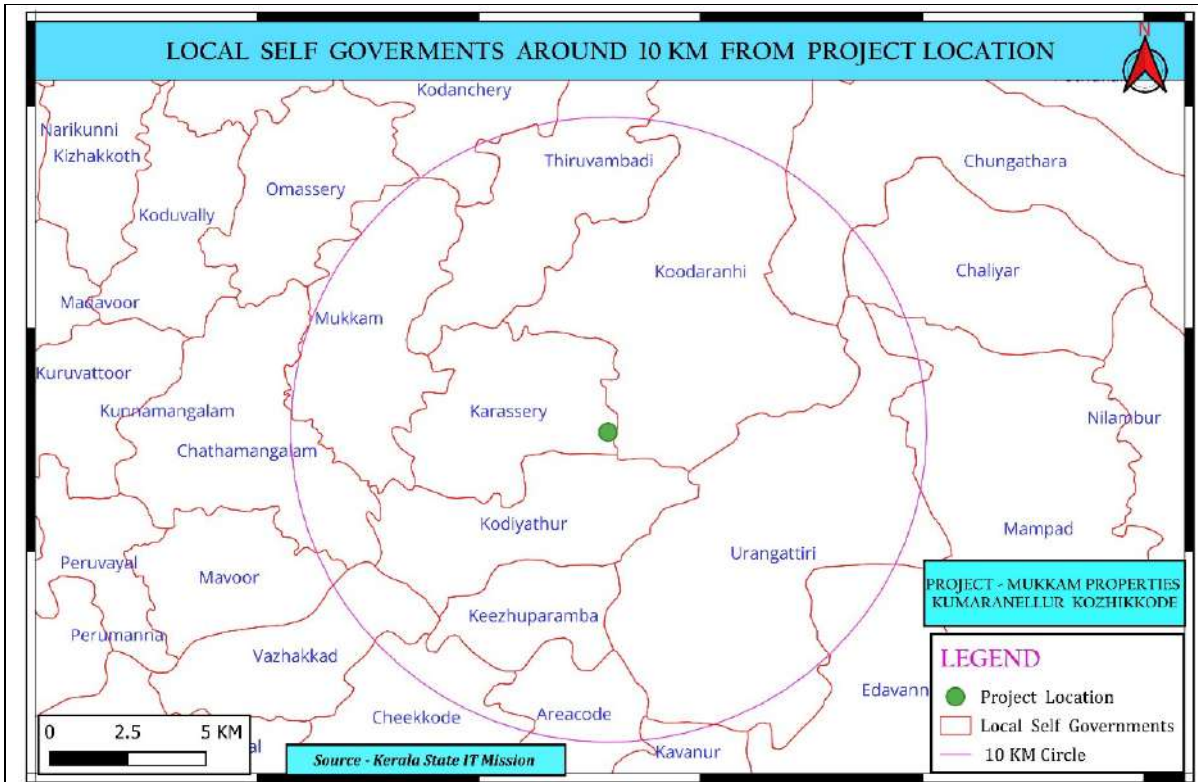


Figure 3.21 : Name of Local Self Government & villages in 10 km periphery of Project site

There are 18 Local Self Government fully and partially comes within the 10 km periphery of the project site. Among them a small portion of Geographical area of Chungathara, Chaliyar, Mampad, Edavanna, Kavanoor, Mavoora, and Kodanchery Grama Panchayats are coming within 10 Km periphery of Project site. Since small part of Geographical area of these Local Self Governments comes in the study area, does not included population status in the base line data of demographic profile. There are 18 LSG coming within the study area out of them full geographical area of Karassery, Keezhuparamba and kodiyaathoor Grama Panchayats, majority geographical area of 4 Grama Panchayat and partial geographical area of 4 Grama panchayat, altogether 11 panchayats are taken for assessment of demographical profile. Among them 6 Grama Panchayat is in Kozhikode District and 5 Grama Panchayats in Malappuram District.

Geographical Area

The geographical area of each Local Self Government is provided in the table below.

Table 3.22 : Geographical area of each Local Self Government of the study area

SN	Local Self Government (LSG)	Household	Sq. Km.
1	Karassery (Full)	6847	36.90
2	Thiruvambadi (Major)	6771	83.96
3	Koodaranhi (Major)	4423	98.21
4	Urangattiri (Major) Malappuram	7684	76.09
5	Areecode(Part) Malappuram	6037	12.21
6	Cheekode(Part) Malappuram	6297	23.96
7	Keezhuparamba (Full) Malappuram	4500	14.99
8	Vazhakkad(Part) Malappuram	7435	23.78
9	Kodiyathur(Full)	6024	29.81
10	Chathamangalam(Part)	10526	40.24
11	Mukkom(Major)	9270	31.28
	Total	75814	471.43

Source :- Census 2011, Govt. of India.

Among the above 11 LSG, the Thiruvambadi Grama panchayat is having biggest Geographical area and Areecode Grama Panchayat is having the smallest geographical area.

Demographic Profile

The demographic profiles of the 11 Local Self Governments are given below.

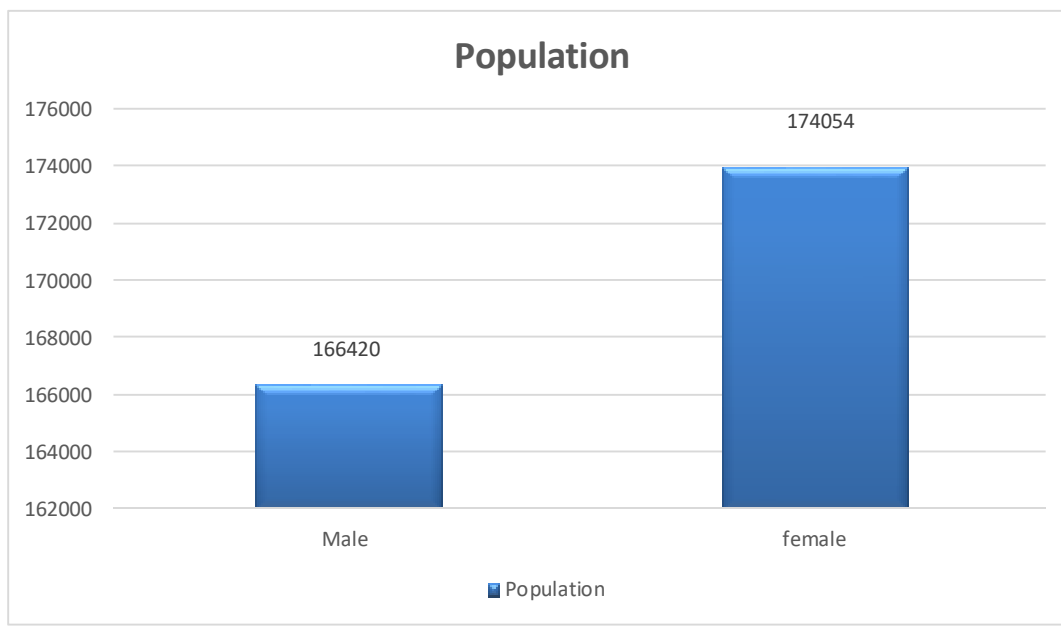
Table 3.23 : Demographic profiles of the 11 Local Self Governments

SN	Local Self Government (LSG)	Total population	Male	Female	Density of Population
1	Karassery (Full)	31536	15114	16422	854.63
2	Thiruvambadi (Major)	28820	13988	14832	343.26
3	Koodaranhi (Major)	18678	9242	9436	190.18
4	Urangattiri (Major) Malappuram	40297	19925	20372	529.87
5	Areecode(Part) Malappuram	31563	15628	15935	2585.01
6	Cheekode(Part)	32867	16098	16769	1371.74



	Malappuram				
7	Keezhuparamba (Full) Malappuram	22062	10810	11252	1471.78
8	Vazhakkad(Part) Malappuram	35774	17280	18494	1504.37
9	Kodiyathur(Full)	28335	14013	14322	950.52
10	Chathamangalam (Part)	46688	14668	15204	1160.24
11	Mukkom(Major)	40670	19654	21016	1300.19
	Total	357290	166420	174054	1114.70

Source :- Census 2011, Govt. of India.



As shown above the number of female populations is higher than male. The densely populated Local Self Government are Areekode Grama Panchayat and Vazhakkad Grama Panchayat.

Weaker Section

The number of weaker section in the total population such as Scheduled Caste, Scheduled Tribe and children are detailed in the table showing below.

Table 3.24 : Number of weaker section in each villages

Sr. No.	Local Self Government (LSG)	SC	ST	Children 0-6
1	Karassery (Full)	3026	606	4167
2	Thiruvambadi (Major)	1673	365	3278
3	Koodaranhi (Major)	812	627	2076
4	Urangattiri (Major) Malappuram	3255	1056	5509



5	Areecode(Part) Malappuram	2991	35	4527
6	Cheekode(Part) Malappuram	2685	46	4754
7	Keezhuparamba (Full) Malappuram	1921	42	3048
8	Vazhakkad(Part) Malappuram	3740	115	5044
9	Kodiyathur(Full)	2261	58	3902
10	Chathamangalam (Part)	3639	49	3265
11	Mukkom(Major)	5494	110	4606
	Total	31497	3109	44176

Source:- Census Data of 2011, Govt. of India.

In total population, 12.36% are children from the age group of 0 to 6 years. 8.81 percentage of persons belongs to Scheduled Caste and 0.87% of people belongs to Scheduled Tribes. The number of scheduled tribes are higher in Urangattiri Grama Panchayat (2.62%).

Occupation

The number of workers, main and marginal workers in the Local Self Governments is provided below in the table.

Table 3.25 : Number of workers, main workers & marginal workers among workers in the Local Self Governments

Sr. No.	Local Self Government (LSG)	Workers	Main Workers among workers	Marginal Workers among workers
1	Karassery (Full)	9600	7893	1707
2	Thiruvambadi (Major)	11477	9041	2436
3	Koodaranhi (Major)	7464	5573	1891
4	Urangattiri (Major) Malappuram	12333	7904	3263
5	Areecode(Part) Malappuram	8446	6343	2103
6	Cheekode(Part) Malappuram	8132	5536	2596
7	Keezhuparamba (Full) Malappuram	6024	4009	2015
8	Vazhakkad(Part) Malappuram	9109	5619	3490
9	Kodiyathur(Full)	7645	6517	1128
10	Chathamangalam (Part)	9486	6963	2523
11	Mukkom(Major)	13165	10564	2601
	Total	102881	75962	25753

Source:- Census Data of 2011, Govt. of India.



To know the economic profile of the population in the 11 Local Self Governments around the project site, the data of census 2011 were analyzed. The data are mentioned in the table given below. In 10 km periphery of the proposed project site 28.79% of population are workers out of this 73.83% of people are active or full time workers. In this study area more than 70% of population are non-workers. Children, senior citizen are coming under in the non-workers category.

Table 3.26 - Expected Job opportunities in the project site

SN	NAME OF THE POST	NOS.
1.	Mine Manager 1 st Class	1
2.	Environment Officer	1
3.	Mechanic (Vehicle and Machinery)	2
4.	Excavator (20 Ton capacity) Operator 1 st shift -(Caterpillar, JCB)	2
5.	Excavator (20 Ton, capacity) Operator 2 nd shift - (Caterpillar, JCB)	2
6.	Excavator (30 Ton, Capacity) Operator 1 st shift - (Caterpillar, JCB)	2
7.	Excavator (30 Ton, Capacity) Operator 2 nd shift - (Caterpillar, JCB)	2
8.	Mines foreman	2
9.	Mines mate	2
10.	Drilling	4
11.	Cleaning – Drilling helper	2
12.	Blasting helpers	2
13.	Quarry in-charge	1
14.	Quarry supervisor	2
15.	Mess (Cook - 1 no. + Helper – 1 no.)	2
16.	Tipper (Taurus) Drivers	6
17.	Tipper cleaners	6
18.	Office staff	4
19.	Helpers and cleaners	3
20.	Security	2
	TOTAL	50



The list opportunist will be published in District Industries Center and Local Self Government after obtaining necessary approvals. In addition to the direct job opportunist many indirect job will be created.

Literacy

The literacy status of each Local Self Government is provided below in the table.

Table 3.27 : Literacy status of each Local Self Government

Sr. No.	Local Self Government (LSG)	Total	Male	Female
1	Karassery (Full)	26028	12577	13451
2	Thiruvambadi (Major)	24629	12011	12618
3	Koodaranhi (Major)	15836	7919	7917
4	Urangattiri (Major) Malappuram	32517	16437	16080
5	Areecode(Part) Malappuram	25414	12800	12614
6	Cheekode(Part) Malappuram	26224	13082	13142
7	Keezhuparamba (Full) Malappuram	18338	9106	9232
8	Vazhakkad(Part) Malappuram	29313	14338	14975
9	Kodiyathur(Full)	23215	11550	11665
10	Chathamangalam (Part)	25541	12743	12798
11	Mukkom(Major)	34375	16825	17550
	Total	281430	139388	142042

Source :- Census 2011, Govt. of India.

In the total population, 78.76% of people are literate. In this 50.47% is female. It is come to know that all children above 5 years in the community is attending primary school either in Govt. or in Aided and Unaided school in the district. In this district 83.75 male are literate and 81.6 females are literate.

Population & Occupational Pattern

Table 3.28 : Population & Occupational Pattern in the study area

Sl.No.	Demographic Feature	Study area	
		Core Zone	Buffer Zone
1	Population	Nil	357290
2	Households	Nil	75814



3	Workers	50	102881
4	Total geographical area	0.081765 sq.kms.	471.43 sq.kms.

Demographic profile of Ward No. 5 (Thekkumkutty)

Table 3.29 : Demographic profile of Ward Number 5 – Thekkumkutty

SN	Specifications	Male	Female	Total
1.	Population	842	1261	2103
2.	Children	90	90	180
3.	Scheduled Caste	26	30	56
4.	Scheduled Tribe	22	27	56
5.	Literate	728	1126	1845
6.	Workers	450	129	579
7.	Main Workers	436	90	526
8.	Cultivators	5	1	6
9.	Agriculture workers	1	0	1
10.	House hold Workers	0	1	1
11.	Other workers	430	88	518
12.	Marginal Workers	14	39	53
13.	Marginal Cultivators	1	1	2
14.	Marginal Agriculture Workers	0	0	0
15.	Marginal House Hold Workers	0	0	0
16.	Marginal Other workers	13	38	51
17.	Non workers	392	1132	1524

The quarry project is proposed in ward number 5 of Grama Panchayat and there is only 6.6% of people are resides in ward number 5 in 377 houses (5.5% of houses in the Panchayat).

Agriculture and its pattern

In Karassery Grama Panchayat, 30.44% of people are engaged in occupation out of them 13.53% engaged in agricultural related activities as full timers and 18.53 % are engaged as part time workers. most of the person are depending upon non agricultural occupations for their livelihood. There are 1723 persons engaged in agricultural related activities among them the



number of females are 333. The details of agriculture (Crop Pattern) in the Karassery Grama Panchayat is provided below.

Table 3.30 : Crop pattern in Karassery Grama panchayat

Name of Crop	Area of cultivation in Ha.
Paddy	7
Coconut	700
Arecanut	600
Banana	70
Tapioca and others	2.6
Pappaya	1
Pineapple	60
Vegitables	3.8
Pepper	5
Turmeric	1
Ginger	1
Nutmeg	5

Source:- Krishibhavan, Karassery Grama Panchayat

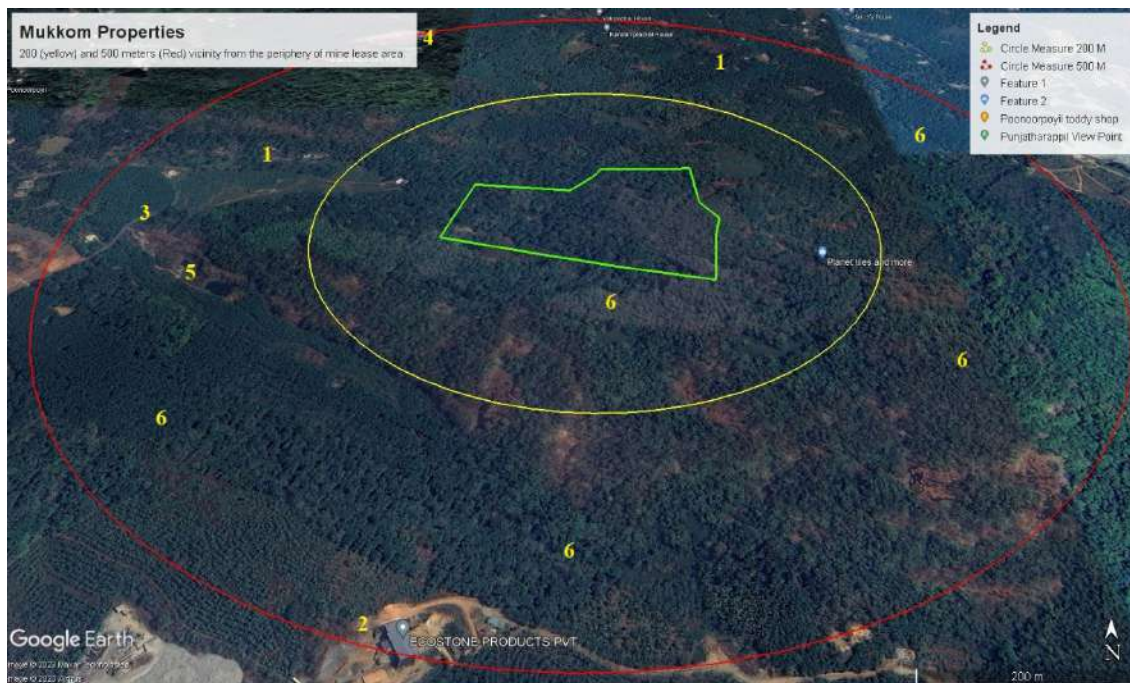
Health

As part of maintain health and treatment of persons living in the Panchayat as well as in the district. There are various hospitals and health clinics working in Government, private and Cooperative sectors. The people can access Allopathy, Homoeo, Ayurveda and Yunani for their treatment in the Panchayat with free of cost. The main hospitals located near to the project site are EMS Memorial Cooperative Hospital, KMCT Medical College, NC Hospital, High Life Ayurvedic Hospital, Mukkam Unani Hospital etc. The Government has been maintaining Primary Health Centers and community health team consist of Health Inspector, Junior Health Inspector, Junior Public Health Nurse, ASHA workers, Pain and Palliative Care Center in all Grama Panchayat.



Structures & Facilities around 500 meters of the proposed project

Sl. No.	Structures & Facility	Numbers
01	Houses	About 25 (west side) About 20 (East side) About 5 (North Side)
02	Crusher	1- Eco stone products Crusher
03	Tarred Public Road	1- West side
04	Mining Projects (Granite Building stone) and allied facility	1- quarry at Maranchatty (NW)
05	Abandoned quarry sites	1- south west side
06	Agriculture (Rubber, coconut Mixed crops)	Yes
07	School	Nil
08	Hospital	Nil
09	Worship places	Nil
10	River and Forest	Seasonal Drain



There is no house in the 200 meter vicinity from the periphery of the project site and about 50 houses in the vicinity of 500 meter vicinity. The majority of houses are in the direction of west and North from the project site. There is a hill in between houses located in the North direction and proposed project site. The slope of the proposed project site is towards west side, the number of houses at west side is about 25. There are no sensitive structures like Schools, Anganwadi, Hospitals, Worship places etc. in 500 meters of vicinity. The majority of the area around the 500 meters periphery is occupied with rubber and other mixed crop plantation.

Rural Needs / Demand of the Community

There is need / demand of the community for construction of Family Health Centre (FHC) in Karassery Grama Panchayat. The followings are the reason for demand of the community.

- Presently, FHC is working in old building
- Lack of adequate space in the existing building
- Lack of Fund with Local Self Government to enhance infrastructure facility

Interpretation

The Karassery Grama Panchayat is having 31536 population among them number of Females is higher than Male. This trend can be seen in all Local Self Government within 10 Km vicinity to the project site. There are 3109 tribal people who are getting basic facilities from Government whereas in Karassery Grama Panchayat resides 606 tribal people. The number of females engaged in occupation is very less when compare with male population. The trend is same in the other Local Self Governments located around the project site. The majority of population are comes under middle income category. The literacy rate of the Karassery panchayat is 82.53%.

3.3.6 Air Environment

Meteorological parameters :

The Climatological table of Kozhikode District (the nearest meteorological station at Kozhikode at about 33 km from the site in south west direction) of observatories in India of 1991-2020 issued by Office of Head, Climate Research & Services, Indian Meteorological Department is referred and is attached at **Annexure No. 3.10.**



Base map of all environmental components

Wind Rose diagram

The wind rose diagram prepared for the area is provided as Figure 3.22.



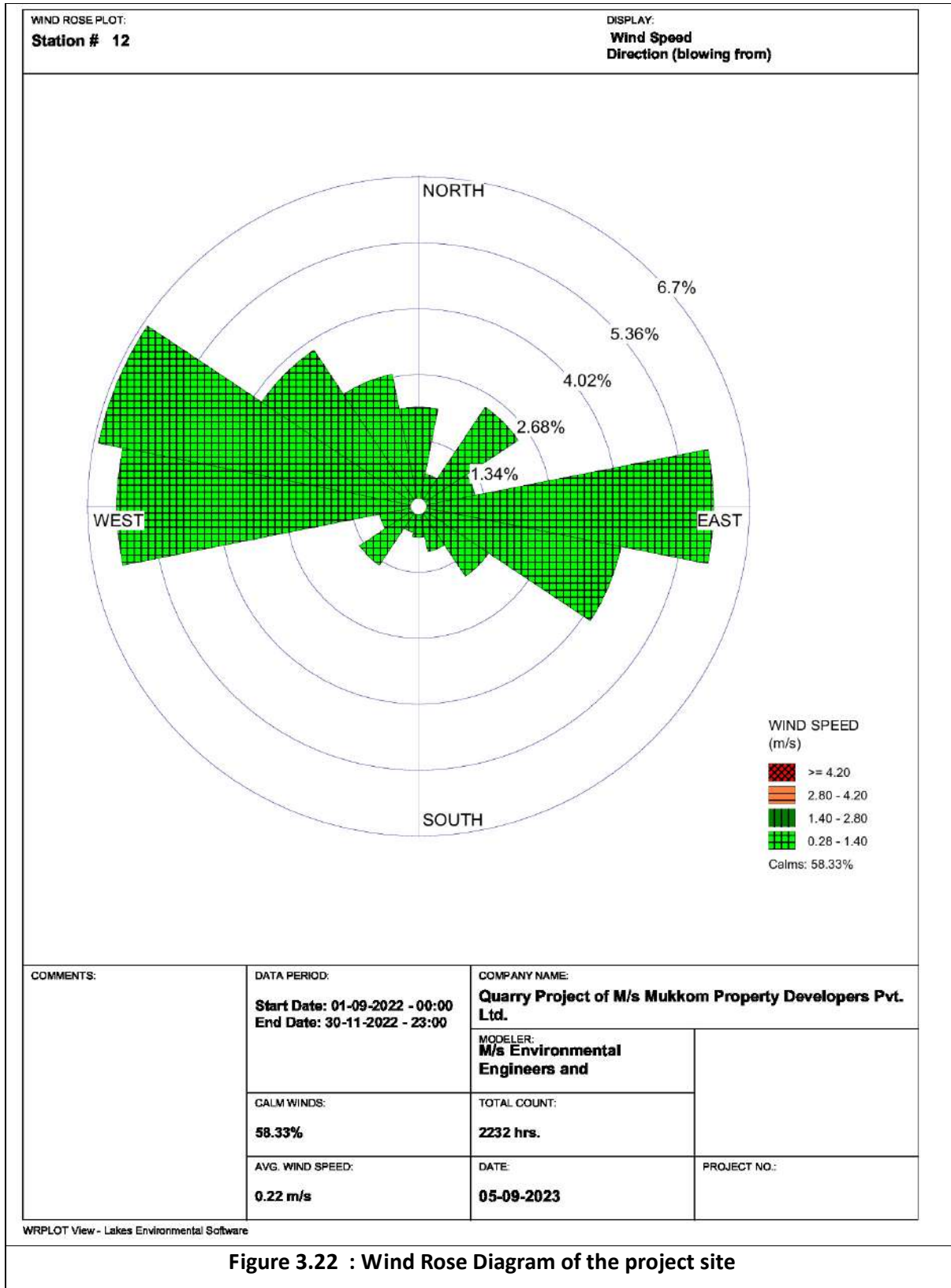


Figure 3.22 : Wind Rose Diagram of the project site



Reason for preparation of wind rose diagram

The wind rose diagram is used for the purpose of selection of ambient air quality sampling locations. From the wind rose diagram, upwind & downwind directions can be identified.

Table 3.31 : Wind Frequency Distribution

	Directions / Wind Classes (m/s)	0.28 - 1.40	1.40 - 2.80	2.80 - 4.20	>= 4.20	Total
1	N	0.02016	0	0	0	0.02016
2	NNE	0.00672	0	0	0	0.00672
3	NE	0.02419	0	0	0	0.02419
4	ENE	0.01165	0	0	0	0.01165
5	E	0.05959	0	0	0	0.05959
6	ESE	0.04167	0	0	0	0.04167
7	SE	0.01703	0	0	0	0.01703
8	SSE	0.00941	0	0	0	0.00941
9	S	0.00627	0	0	0	0.00627
10	SSW	0.00538	0	0	0	0.00538
11	SW	0.01434	0	0	0	0.01434
12	WSW	0.00806	0	0	0	0.00806
13	W	0.06093	0	0	0	0.06093
14	WNW	0.06586	0	0	0	0.06586
15	NW	0.03808	0	0	0	0.03808
16	NNW	0.02733	0	0	0	0.02733
	Sub-Total	0.41667	0	0	0	0.41667
	Calms					0.58333
	Missing/Incomplete					0
	Total					1

Interpretation :-

As per wind rose diagram, the pre-dominant wind direction is from North West to South East direction.



Introduction

The existing ambient air quality of the mine area is very important for evaluating the impact of mining on air environment.

Methodology

The sampling methodology followed for Ambient Air Quality monitoring is as per CPCB norms and the methodology description is provided at **Annexure No. 3.11.**

Selection and number of sampling locations for Ambient Air Quality monitoring as per CPCB norms :

As per CPCB Guidelines for Ambient Air Quality Monitoring for setting up of any ambient air quality monitoring station, the most important thing to be considered prior to the commencement of actual monitoring is to collect background information about sources of Emissions and Meteorological conditions of the study area.

Number of monitoring stations : The number of monitoring stations is selected based on the background information collected on sources and emissions, population figures which can be used as indicators of region variability of the pollutants concentration as given in CPCB guidelines.

Selection of locations for ambient air quality monitoring

The study of baseline status of air environment includes reconnaissance, selection of monitoring locations was considered based on meteorological conditions, as per the elevation / topographic profile as well as nearest IMD station. The wind rose was drawn for the selection of monitoring location considering the meteorological station covering the study area. The monitoring and concentration levels of specific air quality parameters were carried out to assess the status of existing ambient air quality in the study area.

Sampling locations were selected within the study area i.e. one sample at core zone and other locations at sensitive receptors (schools/college) located within the 1.5 km from the mine lease area.

The Ambient Air Quality monitoring locations are listed in Table 3.32 and the map showing the locations is provided Figure 3.23.



Table 3.32 : Ambient Air Monitoring Locations

Location no.	Geo-coordinates	Name of location	Distance & direction	Remark
AAQ1	11°18'38.61"(N) & 76° 4'17.69"(E)	Quarry site (ML area)	Within the site	Core zone
AAQ2	11°18'45.70"(N) & 76° 4'0.87"(E)	Own house of M/s Mukkam properties	About 270 m. (NW direction)	Upwind direction
AAQ3	11°19'14.78"(N) & 76° 3'33.94"E	Near Mary Giri High School, Koodaranhi – Maranchatty Rd, Maranchatty	About 1.5 km (NW direction)	Upwind direction (Sensitive Receptor) (School)
AAQ4	11°18'36.61"(N) & 76° 3'16.72"(E)	Near IHRD College of Applied Science	About 1.5 km (W direction)	Sensitive Receptor (Institutional Campus)
AAQ5	11°19'10.72"(N) & 76° 4'38.23"(E)	Near Fathimabi Memorial HS School, Koombara	About 1 km (NE direction)	Sensitive Receptor (School)
AAQ6	11°17'46.07"(N) & 76° 4'19.29"(E)	Near Government U P School, Chundathupoyil	About 1.5 km (S direction)	Sensitive Receptor (School)



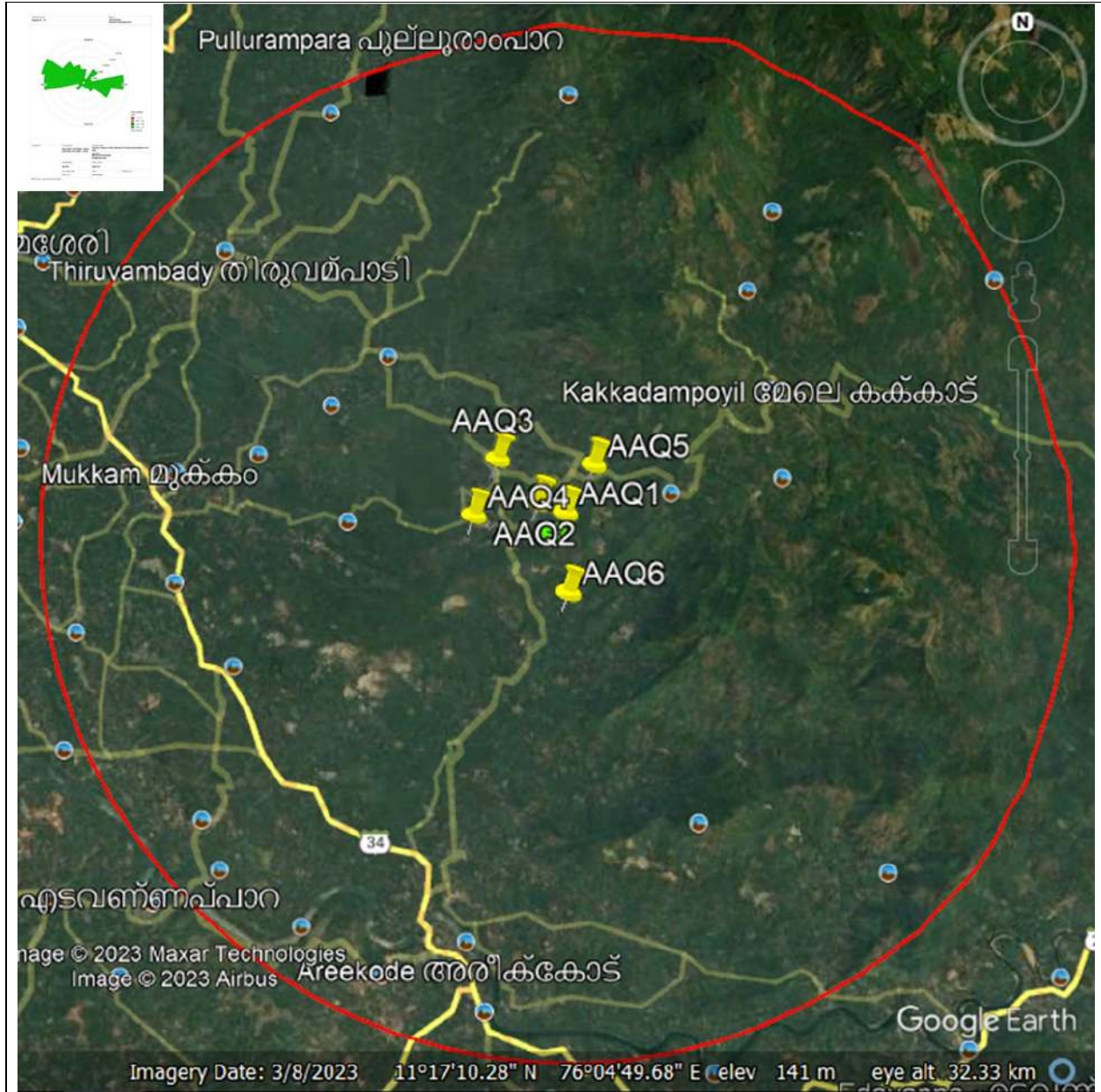


Figure 3.23 - Location of Ambient Air Quality Monitoring Stations
(Source : Google Earth) (Vintage: March, 2023)

Sampling and Analysis results

The ambient air samples were collected in presence of the functional area expert (AP) and analyzed by NABL accredited laboratory, the results are given in Table 3.33. The study period for the EIA project is September, October, November (2023) (post-monsoon season) is carried out and the data is collected accordingly for EIA Study.

Table 3.33 : Ambient Air Quality Monitoring Results

Particulate Matter - PM ₁₀ (µg/m ³)			
Monitoring stations (R,I,S)*	Category of station	Maximum	Minimum
Core zone	AAQ-1	66.6	58.3
Upwind direction	AAQ-2	50.7	43.9
Upwind direction (Sensitive Receptor) (School)	AAQ-3	56.3	43.2
Sensitive Receptor (Institutional Campus)	AAQ-4	49.6	44.2
Sensitive Receptor (School)	AAQ-5	46.3	35.2
Sensitive Receptor (School)	AAQ-6	53.2	40.2
Particulate Matter - PM _{2.5} (µg/m ³)			
Monitoring stations (R,I,S)*	Category of station	Maximum	Minimum
Core zone	AAQ-1	32.2	25.5
Upwind direction	AAQ-2	24.8	20.5
Upwind direction (Sensitive Receptor) (School)	AAQ-3	25.2	18.7
Sensitive Receptor (Institutional Campus)	AAQ-4	26.7	20.1
Sensitive Receptor (School)	AAQ-5	25.5	15.6
Sensitive Receptor (School)	AAQ-6	26.8	18.6
Sulphur Dioxide as SO ₂ (µg/m ³)			
Monitoring stations (R,I,S)*	Category of station	Maximum	Minimum
Core zone	AAQ-1	4.44	BDL (LOD 4.00)
Upwind direction	AAQ-2	BDL (LOD 4.00)	BDL (LOD 4.00)
Upwind direction (Sensitive Receptor) (School)	AAQ-3	4.27	BDL (LOD 4.00)
Sensitive Receptor (Institutional Campus)	AAQ-4	4.51	BDL (LOD 4.00)
Sensitive Receptor (School)	AAQ-5	BDL (LOD 4.00)	BDL (LOD 4.00)
Sensitive Receptor (School)	AAQ-6	BDL (LOD 4.00)	BDL (LOD 4.00)
Oxides of Nitrogen as NO ₂ (µg/m ³)			
Monitoring stations (R,I,S)*	Category of station	Maximum	Minimum
Core zone	AAQ-1	5.21	BDL (LOD 4.00)
Upwind direction	AAQ-2	4.68	BDL (LOD 4.00)
Upwind direction (Sensitive Receptor) (School)	AAQ-3	4.81	BDL (LOD 4.00)



Sensitive Receptor (Institutional Campus)	AAQ-4	5.04	BDL (LOD 4.00)
Sensitive Receptor (School)	AAQ-5	4.11	BDL (LOD 4.00)
Sensitive Receptor (School)	AAQ-6	4.34	BDL (LOD 4.00)
Carbon Monoxide as CO (mg/m³)			
Monitoring stations (R,I,S)*	Category of station	Maximum	Minimum
Core zone	AAQ-1	0.49	0.22
Upwind direction	AAQ-2	0.26	0.18
Upwind direction (Sensitive Receptor) (School)	AAQ-3	0.37	0.18
Sensitive Receptor (Institutional Campus)	AAQ-4	0.35	0.19
Sensitive Receptor (School)	AAQ-5	0.22	0.13
Sensitive Receptor (School)	AAQ-6	0.28	0.15
Lead as Pb (µg/m³)			
Monitoring stations (R,I,S)*	Category of station	Maximum	Minimum
Core zone	AAQ-1	BDL (LOD 0.01)	BDL (LOD 0.01)
Upwind direction	AAQ-2	BDL (LOD 0.01)	BDL (LOD 0.01)
Upwind direction (Sensitive Receptor) (School)	AAQ-3	BDL (LOD 0.01)	BDL (LOD 0.01)
Sensitive Receptor (Institutional Campus)	AAQ-4	BDL (LOD 0.01)	BDL (LOD 0.01)
Sensitive Receptor (School)	AAQ-5	BDL (LOD 0.01)	BDL (LOD 0.01)
Sensitive Receptor (School)	AAQ-6	BDL (LOD 0.01)	BDL (LOD 0.01)

*R : Residential area

*I : Industrial Area

*S : Sensitive area

The analysis reports of all ambient air quality monitoring stations carried out through NABL accredited Laboratory M/s Standards Environmental & Analytical Laboratories, Kochi, Ernakulam (NABL Acc. # : TC-5402) are provided at **Annexure No. 3.12.**

Table 3.34 : National Ambient Air Quality Standards

Parameters	Standards
PM ₁₀	100 µg/m ³
PM _{2.5}	60 µg/m ³
SO ₂	80 µg/m ³
NO ₂	80 µg/m ³
CO	4.00 mg/m ³
Pb	1.00 µg/m ³



Interpretations

Interpretation w.r.t. National Standards

All the analyzed values of all parameters of the core zone and the buffer zone are well within the National Ambient Air Quality Standards.

Interpretation w.r.t. project surroundings

The analyzed values of the parameters w.r.t. the project site and the surroundings are compared. The values of PM₁₀ & PM_{2.5} are within the permissible standards as per NAAQ.

Analysis of PM₁₀ – Silica

Analysis report of PM₁₀ showing value of free silica is provided below :

Table No. 3.35 : -Mineralogical Analysis of PM₁₀

Sr. No.	Parameters	Result	Unit
1	Particulate matter (PM ₁₀)	34.1	µg/m ³
2	Free Silica	0.89	µg/m ³

Equipment Used : Respirable Enviro Dust samplers, Model : RDS 9000.



3.4 Traffic Study

Baseline Data Collection (Traffic Study)

Baseline data collection for traffic study is carried out and the details are provided in Table 3.36.

Table 3.36 – Traffic Analysis study details

Date of Study	: 12-09-2023 (Tuesday)
Name of main Access Road to the quarry site	: Maranchatty - Thottumukkam
Width of the road (tarred portion)	: 6 meters
Width of the road (ROW)	: 8 meters

	Cars	2 wheelers	3 wheelers	Buses	LCV	Trucks	Total	PCU / Hr.
8 am - 9 am	4	12	10	7	7	18	58	58
9 am - 10 am	6	6	8	4	9	0	33	33
10 am - 11 am	7	32	6	4	9	28	86	86
11 am - 12 noon	5	16	9	7	11	14	62	62
12 noon - 1 pm	4	18	4	4	7	7	44	44
1 pm - 2 pm	3	4	3	4	9	11	34	34
2 pm - 3 pm	4	8	8	4	7	21	52	52
3 pm - 4 pm	18	44	16	7	18	42	145	145
4 pm - 5 pm	14	32	11	4	26	0	87	87
5 pm - 6 pm	16	36	18	4	18	63	155	155
TOTAL	81	208	93	49	121	204	756	756



Date of Study	: 12-09-2023 (Tuesday)
Name of main Access Road to the quarry site	: Thottumukkam -Maranchatty
Width of the road (tarred portion)	: 6 meters
Width of the road (ROW)	: 8 meters

	Cars	2 wheelers	3 wheelers	Buses	LCV	Trucks	Total	PCU / Hr.
8 am - 9 am	6	34	5	4	11	21	81	81
9 am - 10 am	4	16	15	7	18	0	60	60
10 am - 11 am	8	24	11	4	26	49	122	122
11 am - 12 noon	9	18	10	4	9	42	92	92
12 noon - 1 pm	13	22	16	7	20	28	106	106
1 pm - 2 pm	5	12	5	7	13	18	60	60
2 pm - 3 pm	10	16	10	4	22	35	97	97
3 pm - 4 pm	14	24	9	4	20	53	124	124
4 pm - 5 pm	20	16	20	7	18	0	81	81
5 pm - 6 pm	18	28	18	7	9	49	129	129
TOTAL	107	210	119	55	166	295	952	952



Date of Study	: 17-09-2023 (Sunday)
Name of main Access Road to the quarry site	: Thottumukkam - Maranchatty
Width of the road (tarred portion)	: 6 meters
Width of the road (ROW)	: 8 meters

	Cars	2 wheelers	3 wheelers	Buses	LCV	Trucks	Total	PCU / Hr.
8 am - 9 am	4	6	4	4	9	11	38	38
9 am - 10 am	2	8	3	4	7	7	31	31
10 am - 11 am	2	16	5	4	15	14	56	56
11 am - 12 noon	3	4	6	4	9	4	30	30
12 noon - 1 pm	4	0	9	4	11	7	35	35
1 pm - 2 pm	6	12	10	0	7	18	53	53
2 pm - 3 pm	8	6	4	7	4	7	36	36
3 pm - 4 pm	3	24	5	4	18	11	65	65
4 pm - 5 pm	12	16	3	4	7	4	46	46
5 pm - 6 pm	8	14	9	7	4	14	56	56
TOTAL	52	106	58	42	91	97	446	446

Date of Study	: 17-09-2023 (Sunday)
Name of main Access Road to the quarry site	: Maranchatty - Thottumukkam
Width of the road (tarred portion)	: 6 meters
Width of the road (ROW)	: 8 meters

	Cars	2 wheelers	3 wheelers	Buses	LCV	Trucks	Total	PCU / Hr.
8 am - 9 am	2	16	3	4	4	4	33	33
9 am - 10 am	4	6	1	7	9	7	34	34
10 am - 11 am	6	10	5	4	7	4	36	36
11 am - 12 noon	8	14	8	4	11	11	56	56
12 noon - 1 pm	0	4	4	4	9	4	25	25
1 pm - 2 pm	4	6	6	7	7	7	37	37



2 pm - 3 pm	3	8	3	4	2	14	34	34
3 pm - 4 pm	2	12	5	4	2	7	32	32
4 pm - 5 pm	8	24	10	7	4	14	67	67
5 pm - 6 pm	10	16	9	4	7	28	74	74
	47	116	54	49	62	100	428	428

Type of Vehicle	PCU
Car, taxi, pick up	1.0
Cycle, motor cycle	0.5
Bus, truck,	3.5
Horse drawn cart	4.0
LCV	2.2
3-Wheeler	0.8

The map showing road network within 10 km from the ML area is provided at Figure 3.24.



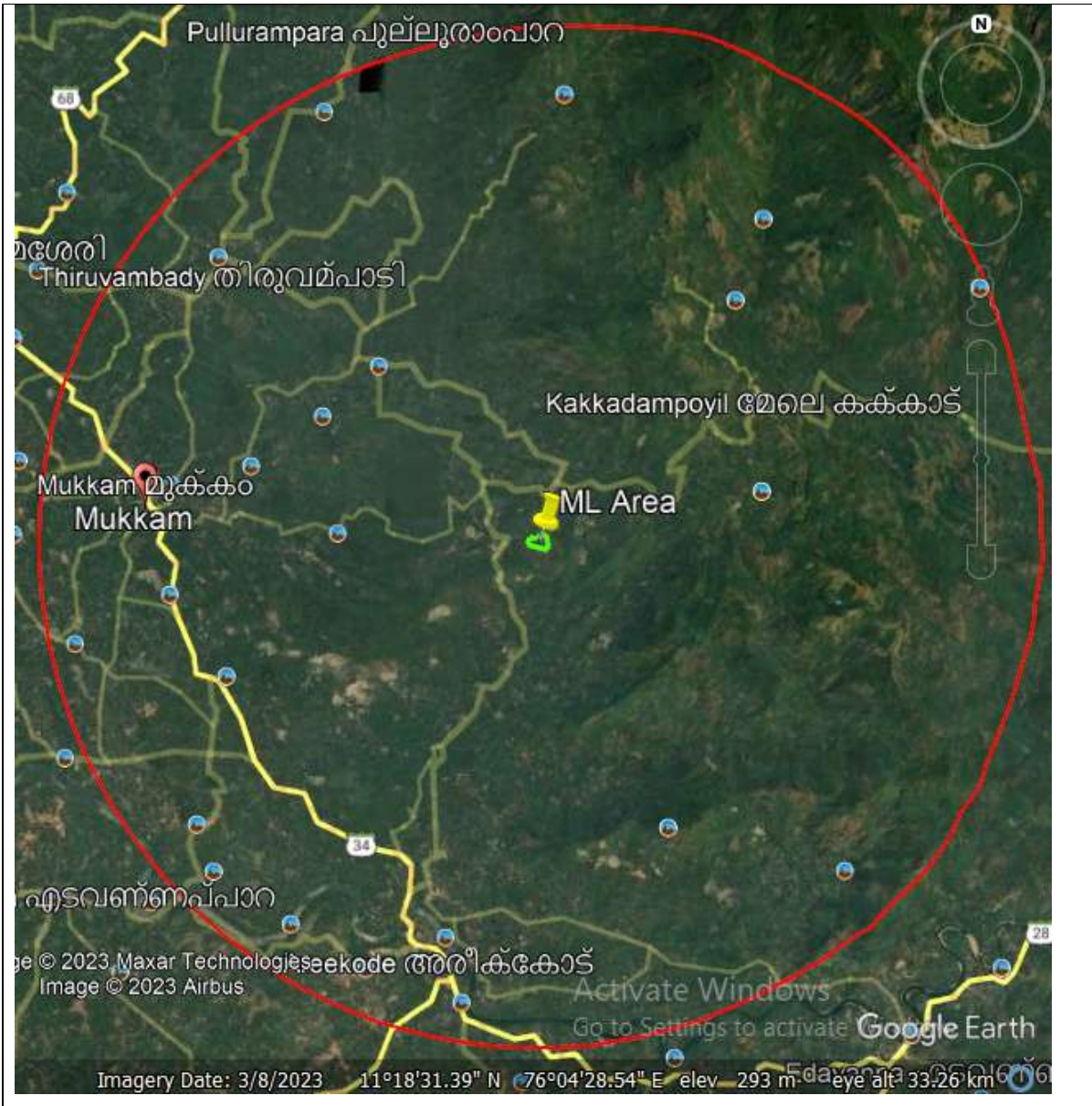


Figure 3.24 – Map showing road network within 10 km from the ML area (Source : Extracted from Google Earth) (Vintage: March, 2023)

Interpretation

- A traffic study was carried out to access the current traffic on *Maranchatty-Thottumukkam* Road (both directions). All the products / material from the proposed quarry reaches in the surrounding panchayaths of Kozhikode district like Karassery, Thiruvambadi, Koodaranhi, Kodyathur, Chathamangalam, Mukkom and Panchayats located in the Malappuram district which are Urangattiri, Areecode, Cheekode, Keezhuparamba, Vazhakkad etc. for supply to the end users at different locations within the Kozhikode & Malappuram District. The



existing roads width located nearby the quarry are sufficient for additional traffic load from the proposed mine.

- The V/C of *Maranchatty-Thottumukkam* Road related to IRC guidelines are referred and it is 0.3.
- After the commencement the proposed mining activities, the traffic from the mine will be able to cater the traffic in *Maranchatty-Thottumukkam* Road.
- The rubble from the proposed mine will be sent to open market / stone crusher units located within 5 to 8 kms from the proposed mine site. The aggregates from the proposed mine will be sold to Calicut Expressway Private Limited for construction of proposed six lining of existing Kozhikkode Bypass (Vengalam junction to Ramanattukara junction) as part of infrastructure works.



CHAPTER – 4

ANTICIPATED ENVIRONMENTAL

IMPACTS

&

MITIGATION MEASURES

4.0 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

Introduction

This chapter deals with the anticipated environmental impacts due to the proposed mining activities of the proposed mine. Further, this chapter deals with the mitigation measures for the identified significant environmental impacts of the mining activities of the proposed mine.

4.1 Details of Investigated Environmental Impacts due to project location, possible accidents, project design, project construction, regular operations, final decommissioning or rehabilitation of a completed project.

Anticipated Environment Impacts

Identification of all potential Environmental Impacts due to the open cast mining activity is an essential step of environmental impact assessment. These are critically examined and major impacts (both beneficial and adverse) are further examined and studied. In the mining project, the impact on land environment (waste management), water environment, noise environment & vibration, ecological environment, social issues and air environment are significant. The significant impacts due to the mining activity will be on land use, drainage, air quality, ecology, noise, vibration, social impacts etc. Allied operations such as transportation of materials, operation of work shop, drilling, blasting etc. affect the air, water and noise environment. Clearance of natural vegetation adversely affects the flora and fauna of the areas due to the changed environment and loss of habitats. There are few positive impacts like creation of employment opportunities and development of infrastructure such as roads etc due to the proposed mining activity.

Parameters of Impacts

The parameters of deciding the impacts are provided at Table 4.1.

Table 4.1 - Parameters of Impacts

Sr. No.	Parameters of Impact	Description
1.	Type	Positive & Negative
2.	Nature	Direct, Indirect
3.	Magnitude	Low, Moderate, High
4.	Timing	Short term, Long term, Intermittent



5.	Duration	Temporary / Permanent
6.	Reversibility	Revisable / Irreversible
7.	Significance	Local, regional & global

4.2 Assessment of significance of impacts (Criteria for determining significance, Assigning significance)

The significance of the impact is decided based on the following criteria.

- Whether the environmental aspects have potential to cause direct impact or indirect impacts?
- Whether the environmental aspects would violate legal/mandatory requirement if uncontrolled?
- Whether the likely environmental impact will be limited to local surroundings or it would be wide spread?
- Whether the likely environmental impact would be of a temporary nature or permanent nature depending on the toxicity levels?
- Whether the occurrence of the environmental aspects and its likely environmental impact will be of long term nature or short term nature?
- Whether mitigation measures available and can be adopted to minimize the significance of the impacts to permissible limits?

The above criteria has been shown in the table below (Table 4.2):-

Table 4.2 – Criteria for Evolving Significant Impacts

SN	Criteria	Classification	
		Direct	Indirect
1.	Whether the environmental aspects has potential to cause direct impact or indirect impact.	Direct	Indirect
2.	Whether the environmental aspects would violate legal / mandatory requirement if uncontrolled	Mandatory	Not Mandatory
3.	Whether the likely environmental impact will be limited to local surroundings or it would be wide spread.	Local	Wide spread
4.	Whether the likely environmental impact would be of a temporary nature or permanent nature depending on the toxicity levels.	Temporary	Permanent
5	Whether the occurrence of the environmental aspects and its likely environmental impact will be of long duration in	Long Term	Short Term



	nature or short duration.		
6	Whether mitigation measures available and can be adopted to minimize the significant of the impacts to permissible limits.	Yes	No

4.3 Environmental Aspects & their Anticipated Impacts from the mining project

4.3.1 Aspects and impacts – Instant proposal

The environmental aspects & their anticipated impacts during mining operation phase are presented in the Table 4.3.

Table 4.3 : Matrix of Environmental Aspects & their Anticipated Impacts from the proposed quarry

SN	Activity / Aspect	Anticipated Impacts
LAND ENVIRONMENT		
1	Mining in steeper slope	➤ Mining in slope more than 45 ⁰ (steeper slope) can develop unstable slope and aggravate the chances of landslide and subsequent damage to the life and property of people in the downslope.
2	Mining in max. slope of 25 ⁰	➤ Mining in moderate slope of around 25 ⁰ can also develop moderate unstable slope and can induced landslide and subsequent impact to the life and property in the downslope.
3	Chances of landslide	<ul style="list-style-type: none"> ➤ As per the Landslide Zonation Map prepared by State Disaster Management Authority (SDMA) of Kerala, it can be inferred that the about 90% of the ML area is falling within Medium Hazard Zone area (Moderate Zone) and remaining area is safe zone. The nearest High Hazard Zone is 4.4 km (NE direction) from the proposed ML area. ➤ Chances of slide of the top soil / over burden in 7.5 m safety zone (buffer area) at the upper most portion of mine lease area and the slide can cause damage to man & machinery. ➤ Chances of collapse of the top soil / over burden dump can cause damage to man & machinery.
4	Mining activities** in the proposed ML area (8.1765 ha.)	➤ Alteration of landscape and change of land use.
5	Change in the quality of soil	➤ Quality of soil w.r.t. pH and other nutrients are poor and the discharge from the mining activities including the overland flow with traces of explosive leaching to the ground affecting the quality of soil



6	Loss of top soil	➤ Loss of top soil impacts the vegetation growth and agriculture activities.
7	Increase in soil erosion due to increase in runoff (increase of about 100%)	➤ Increase in soil erosion reduces the fertility of soil due to loss of fertile top soil.
8	Loose boulders of various sizes	➤ Loose boulders can cause fatal injury to workmen / damage to machinery and the residents in the downslope.
<p>Conclusion The mining activity will have negative, direct, low, short term, temporary, reversible and local impact on Land environment.</p>		

WATER ENVIRONMENT

[Specific ToR (3) – “Study the impact on the hydrology of the region by considering the local rainfall, and seasonal and ground water variations and also propose mitigative / management measures”]

[Specific ToR (4) – “The natural stream which receives the drainage from the project area should be assessed at upstream and downstream regions to maintain its ecological functions”]

SN	Activity / Aspect	Anticipated Impacts
1.	Increase in overland flow from the ML area	<ul style="list-style-type: none"> ➤ Impact on the hydrology of the region due to increase in overland flow in the ML area and surroundings. ➤ Increase in overland flow (100 ML/year) lead to flooding conditions in the downstream and threat to life & property in the vicinity.
2.	Seasonal drain and overland flow	➤ Impact on seasonal drain in the west direction due to the increase in overland flow.
3.	Damage / loss of water shed due to mining activities.	➤ Damage of watershed causes water scarcity in the downstream areas and impacts people and ecology in the vicinity.
4.	Mining below the ground water table. (below the lowest level of 45 meters AMSL)	➤ Depletion of the ground water table resultantly impact the open wells in the vicinity and water scarcity to surrounding residents.
5.	Quality of water of seasonal drain and murky overland flow from project area	<ul style="list-style-type: none"> ➤ Increase in soil erosion and deterioration of water quality in the surface water body and impact aquatic life due to the turbid matter in the surface runoff. ➤ Murky water prevent floral growth in water bodies. ➤ Land use changes and changes in the quality of water and deposition of sediments, impacts the sediment - dwelling species in the fresh water ecosystem.



6.	Loose earth in mining area and in the top soil & over burden dump area carried away by surface runoff	<ul style="list-style-type: none"> ➤ Clogging of streams (drainages) by sediments other turbid materials may lead to flooding conditions in the downstream and threat to life & property in the vicinity. ➤ Turbid matter in the overland flow impacts the agricultural fields in the downstream.
7.	Oil spills from mining activities and from machineries in mining area.	<ul style="list-style-type: none"> ➤ Oil spill floats of water and prevent sunlight from passing through it prevents photosynthesis of aquatic plants. ➤ The oil spill in water body disrupts the food chain.
8.	Construction debris / mine waste	<ul style="list-style-type: none"> ➤ The construction debris / mine waste, if dumped in the non-designated areas & inappropriate manner and when it rains, the water carrying, the dumped muck deposited in the river ecosystem and result in swelling of ecosystem.
9.	Use of large quantity of water drawn from ground water or from public supply for dust suppression, domestic purposes & green belt development etc. (35 KLD)	<ul style="list-style-type: none"> ➤ Use of large quantity of water drawn from ground water or from surface water body or from public supply of existing supply line impact to the competing users in the vicinity.
<p>Conclusion The mining activity will have no negative or direct, long term, permanent and regional impact on the water environment.</p>		

NOISE ENVIRONMENT & VIBRATION

[Specific ToR (1) – “*Vibration studies to evaluate the zone of influence and impact of blasting on the neighbourhood as suggested in para (e) of OM No Z -11013/57/2014-IA.II (M) dated 29-10-2014 of MOEF&CC*”]

SN	Activity / Aspect	Anticipated Impacts
1.	Vibration due to blasting and its effect to the nearby built-structures	<ul style="list-style-type: none"> ➤ Increase in vibration level due to blasting by explosives (PPV level more than 15 mm/sec) can damage to the built-structures and resultant threat to life and property. ➤ Increase in vibration level impacts the communication between faunal species ranging from insects to elephants. ➤ Vibration is important in predator, pre-interaction, mother and young relationship, mate choice and recruitment of foods. ➤ Amphibians are the most impacted faunal species due to increase in vibration level.



		<ul style="list-style-type: none"> ➤ Excessive charge in blast holes can generate (more than 500 grams / hole) fly rocks beyond the safety setback and can damage structures and sometime fatal to human being and to faunal ecology. ➤ Vibration studies to evaluate the zone of influence and impact of blasting on the neighbourhood as suggested in para (e) of O.M.No. Z-11013/57/2014-IA.II (M) dated 29-10-2014 of MOEF&CC".
2	Movement of heavy machineries & mining activities** including blasting and resultant increase in noise level.	<ul style="list-style-type: none"> ➤ Increase in noise level due to drilling & blasting etc. impact to health of people in the vicinity (sleeping disorders, neurological problems, hearing problems etc.) ➤ Disturbing the circadian rhythm of plants. ➤ Increase in noise level, of plants of flora which depend on noise affected fauna to pollinate and spread their seeds. ➤ Increase in noise level makes difficult for fauna to use sound for navigation, finding food, mating and avoiding predators, affecting many animal’s ability to survive. ➤ Increase in noise level change animal behavior. ➤ Due to increase in noise level, there is reduced reproductive success, higher mortality and intensified migrations. ➤ Modeling studies were carried out to assess the impacts due to the mining operations of proposed quarry and the predicted values of noise level at the nearest habitation is found within the permissible ambient noise level standards.
<p>Conclusion</p> <ul style="list-style-type: none"> ➤ The mining activity will have direct, low, short term, temporary and local impact on the vibration & noise environment. 		
ECOLOGICAL ENVIRONMENT		
SN	Activity / Aspect	Anticipated Impacts
[Specific ToR (2) – “Study the Impact on Forest and Wild Life”]		
1	Cutting of trees [about 1,800 trees (1,643 trees in mineable area + 159 trees in 7.5 m. buffer area)] & clearance of tree saplings, shrubs, herbs, climbers, ferns etc.	<ul style="list-style-type: none"> ➤ Clearing and cutting of trees, tree saplings, shrubs and herbs during the mining operations will have impact on ecological environment by way of loss of habitat and loss of bio-diversity. ➤ Increase in vibration level impacts the communication between faunal species ranging from insects to elephants. ➤ Vibration is important in predator, pre-interaction, mother and young relationship, mate choice and recruitment of foods. ➤ Amphibians are the most impacted faunal species due to increase in vibration level.



		<ul style="list-style-type: none"> ➤ Increase in noise level, of plants of flora which depend on noise affected fauna to pollinate and spread their seeds. ➤ Increase in noise level makes difficult for fauna to use sound for navigation, finding food, mating and avoiding predators, affecting many animal's ability to survive. ➤ Increase in noise level change animal behavior. ➤ Due to increase in noise level, there is reduced reproductive success, higher mortality and intensified migrations. ➤ Dust emissions (particulate matter) impact to flora (reduced absorption of light, reduction in photosynthesis, decreased rate of carbon dioxide exchange, stomata clogging, reduction in plant growth, reduction local biodiversity, reduction in primary production, altered food chain and food web) and fauna (impacts animal movements, navigation, migration, finding food, mating, avoiding predators, reduction in visibility of animals, causing respiratory diseases, reduction in local biodiversity, altered food chain and food web) in the vicinity.
2	Mining activities - Impact on Forest and Wild Life	<ul style="list-style-type: none"> ➤ The proposed quarry area is located 101 m. from the Forest Area (E & S) without fencing which will leads to falling of faunal species and human into the quarry pits which causes damage to the faunal species. ➤ Increase in man and animal conflict and resultant damage to the property and life of human and domestic animals.
3	Invasive species found in the ML area (7 types of species)	<ul style="list-style-type: none"> ➤ Impact on local species of crops / agriculture. ➤ The invasive species damages the soil quality & impact on ground water quality and available of water.
<p>Conclusion</p> <p>The mining activity will have negative, direct, low, short term, temporary, reversible and local impact on the ecological environment.</p>		
SOCIO-ECONOMIC ENVIRONMENT -		
1	<ul style="list-style-type: none"> • Impact on public facilities & infrastructure due to outstation mining workers (about 50 workers) and outstation workers for the mining activity will be camped within the complex and all amenities like food, electricity, water, sanitary facilities, basic health facilities etc., will be provided within the complex. • Employment opportunities – Direct employment (about 50 persons) & indirect employment (about 150 persons) from the instant quarry. • Taxes & other revenue from the quarry to the State Govt. - The revenue from the quarry facilitate the enhancement of infrastructure development in the area. The annual 	



	<p>income to the Government by way of taxes and duties will be about <u>Rs. 144 Lakhs (Rs. 48/- x 3,00,000 MT)</u> from the proposed mine operation.</p> <ul style="list-style-type: none"> • Increase in economic activities (<u>about Rs. 170 lakhs/year</u>) in the vicinity of the ML area after setting up of the proposed mine. • Increased availability of building construction materials with reduces cost of construction in vicinity & which will enhance the socio-economic status of the vicinity. 	
	<p>Conclusion:</p> <ul style="list-style-type: none"> ➤ The mining activity will have positive & negative, direct, long term, permanent impact on the socio economic environment. 	
AIR ENVIRONMENT		
SN	Activity / Aspect	Anticipated Impacts
1	Mining activities** and resultant generation of dust emissions (particulate matter)	<ul style="list-style-type: none"> ➤ Dust emissions (particulate matter) impact to health of people (breathing difficulties, bronchitis and lung diseases, neurological disorders etc.). ➤ Dust emissions (particulate matter) impact to flora (reduced absorption of light, reduction in photosynthesis, decreased rate of carbon dioxide exchange, stomata clogging, reduction in plant growth, reduction local biodiversity, reduction in primary production, altered food chain and food web) and fauna (impacts animal movements, navigation, migration, finding food, mating, avoiding predators, reduction in visibility of animals, causing respiratory diseases, reduction in local biodiversity, altered food chain and food web) in the vicinity.
2	Mining activities** and resultant generation of gaseous emissions	<ul style="list-style-type: none"> ➤ Acidifying water bodies due to SO_x emissions (lakes, streams, wetlands) lowers the aquatic biodiversity by destruction of aquatic flora and fauna. ➤ Deforestation through the damaging of vegetation. ➤ Depriving the soil of essential nutrients ➤ Fauna exposed to high concentration of SO_x show decreased respiration, inflammation of air ways and damage to lungs. ➤ Reduced faunal reproductive success. ➤ Decrease in the birds egg laying ➤ NO_x emissions is toxic to flora, reduces plant growth. ➤ NO_x emissions impacts reversible and irreversible lung effects. ➤ NO_x emissions have direct impact on kidney and liver of fauna.
	<p>Conclusion</p> <p>The mining activity will have direct, low, short term, temporary and local impact on the air environment.</p>	



*****Mining activities (clearing of vegetation, removal of top soil + OB, drilling, blasting, rock breaking, loading of boulders, transportation of boulders).***

4.4 Measures for minimizing and / or offsetting adverse impacts identified.

4.4.1 Mitigation measure for Land Environment:

Pre-mining operations – Mitigation measures

- Prevent inadvertent entry by persons or animals in buffer zone for which barbed fencing of about 4 feet height will be provided.
- Identification of suitable location for storage of top soil / overburden dump outside the ML area at the lower contour and construction of a retaining wall with weep holes.
- Construction of haulage road as per slope of the ML area.

During the mining operations – Mitigation measures

- The topsoil excavated from the quarry will be dumped / stacked separately at pre-determined place at lower contour of mine with retaining wall and weep holes will be provided and subsequently this will be utilized in spreading over reclaimed areas for plantation as part of eco-restoration so as to prevent the dump material is carried away through overland flow and gets deposited in the surface water bodies / river ecosystem and result in swelling of ecosystem.
- The overburden (OB) will be generated throughout the mine life. This waste will be utilized within the pit and for laying of haul roads. At the end use, OB can be reutilized as soil base for plantation.
- No mining activity would be carried out in steeper slope (slope more than 45⁰).
- Mining activity in moderate slope (around 25⁰) will be carried out with appropriate slope stability and protection measures.
- As per the Landslide Zonation Map prepared by State Disaster Management Authority (SDMA) of Kerala, it can be inferred that the about 90% of the ML area is falling within Medium Hazard Zone area (Moderate Zone) and remaining area is safe zone. The nearest High Hazard Zone is 4.4 km (NE direction) from the proposed ML area. The NOC from the District Disaster Management Authority will be taken by the PP before commencement of the mining and the conditions imposed will be complied meticulously.



- Break the loose boulders in situ without blasting before commencement of regular mining located in the core area & near to buffer-7.5 meters.
- The poor quality of soil will improve w.r.t. pH and other nutrients by multi crop plantation in the eco-restoration phase added with addition of nutrients as supplement.
- Conservation of top soil for future eco-restoration work. The dump shall be provided at the lower contour with retaining walls with weep holes and with a garland drain around the dump.
- A safety zone of 7.5 m (buffer zone) would be maintained.

Post mining phase land use – Mitigation measures

The land use of the proposed project with ML area of 8.1765 ha. in the mine closure phase is provided below. Out of the total area, 5.6902 ha. + 0.7986 ha. = 6.4888 ha. (79% of the total area) will be with plantation in the mine closure phase and an area of 1.5881 ha. (about 20% of the total area) will be a converted into storm water collection pond. Development of plantation and a storm water collection pond are environmental friendly activities. The map showing mine in the conceptual phase which is part of the Approved Eco-Friendly mine plan is provided at Annexure No. 2.5 (A) & (B).

Table 4.4 - Land use of the proposed project during mine closure phase.

Sr. No.	Land Use Category	Pre-Operational (Ha.)	Operational for next five years (Ha.)	Post Operational for life of mine (Ha.)
1	Top Soil Dump	Nil	Nil	Nil
2	Over burden	Nil		
3	Excavation (Voids Only)	0.2851	4.3871	7.2783 (5.6902 ha. Reclaimed by plantation & 1.5881 ha. Convert to pond)
4	Road	0.0000	0.2498	Nil
5	Water pond	Nil	Nil	Nil
6	Drainage	0.0000	0.0996	0.0996
7	Green belt	Nil	0.7986	0.7986
8	Undisturbed area	7.8914	2.6414	0.0000
Total		8.1765	8.1765	8.1765



4.4.2 Mitigation measures for Water Environment:

[Specific ToR (3) – “Study the impact on the hydrology of the region by considering the local rainfall, and seasonal and ground water variations and also propose mitigative / management measures”]

[Specific ToR (4) – “The natural stream which receives the drainage from the project area should be assessed at upstream and downstream regions to maintain its ecological functions”].

Pre-mining operation – Mitigation Measures

- Construction of garland drain with intermittent silt traps
- Construction of a large storm water collection pond (about 8 ML capacity) for the storage of rain water to be located outside the mine lease area at the lower contour.

During the mining operation – Mitigation Measures

Impact of Hydrology vs Mitigation Measures -

- There is increase of 100 ML of overland flow and to reduce its impact on the seasonal drain, a large rain water collection pond of capacity about 8 ML will work as a cushion / shock absorber so as to reduce the impact on the seasonal drain. Necessary carrying capacity study is carried out on the drain based on the peak rainfall.
- A study on ground water of 1 km surrounding of the core zone was carried out and based on which, the ultimate depth of mine is decided. It is observed that the ground water table is in the range of 42.0 MSL – 44.8 MSL. The ultimate depth of mining is fixed at 45 MSL. Hence there is no intersection of ground water table and no impact on hydrogeology.

Loss of watershed and its mitigation measures

- The strengthening of green area development in the 7.5 meters buffer zone and in the benches and in the compensatory afforestation area will increase moisture retention in soil.
- Storm water collection pond (about 8 ML capacity) will enhance the moisture retention in the surrounding soil.
- The species selected for green belt development and for compensatory afforestation will be all native which can slow the surface runoff thereby soil erosion can be reduced. The slower runoff lead to more percolation through water holding.



Assessment of the water quality of natural stream which receives the drainage from the project area.

- The water quality of the natural drain in the vicinity of the project site (upstream and downstream) will be monitored periodically (once in 3 months) to assess the quality of water.

Other mitigation measures**Overland flow**

- The garland drain as per the drainage map and a reservoir (pond) in the lower contour (outside the mine lease area) will channelize and store the runoff from the mine area in the reservoir (pond).
- The runoff from the mine area is collected in the large reservoir to be constructed in the lower most contour of the area and all sediments / silt in the runoff will get settled in the reservoir. Only supernatant clear water will leave the reservoir.
- Stone barriers across the garland drains and with de-silt chambers to be constructed to check the water current and arrest the sediments.
- Stone pitching to be made at suitable locations to regulate water flow and prevent soil erosion.
- Periodical cleaning of de-siltation chambers and storm water collection pond.
- Small drains to be provided in every bench (the benches are inclined inward) which will be connected to the garland drain.
- Arrangement will be made at the edge of bench to prevent direct fall of runoff.
- The proposed quarry need to construct de-siltation traps, settling tanks / clarifiers along the drainages before storm water runoff (murky water) settling in rain water harvesting pond.
- The discharge from the vehicle work shop / runoff from the workshop area to be treated by providing oil and grease cum grit chamber.
- Measures to minimize contamination of surface and groundwater sources by disposal of sewage through septic tank.
- The drainage plan of the ML area is provided at Figure 4.1.



- The Environmental Plan showing the drainage network, Compensatory afforestation area, storm water collection pond, top soil and over burden storage area is provided below in Figure 4.2.
- The water requirement for various mine related activities including dust suppression and for green area development will be met from the stored rain water in the reservoir and hence the ground water abstraction, sourcing of water from the nearby surface water and from the public supply is avoided for these activities. Therefore, there is no impact on hydrology of the area.
- Water balance of the impact zone is prepared based on the water harvesting and usage. The details of water balance of the mine is given below :-

Sr. No.	Particulars	Water Requirement (in KLD)	Source
1.	Domestic purposes (mine staff)	7	Open well
2.	Dust Suppression / Water sprinkling at mine	14	Storm water pond
3.	Green belt / Plantation	14	
	Total	35	

Post-Mining Operation – Mitigation Measures

- At the end of mining (from the proposed ML area) a storm water collection pond of about 100 ML capacity will be formed and the water stored can be utilized for irrigation purposes in the downstream during summer months.
- The PP will secure the storm water collection pond which will be formed at the end of the mining operations with appropriate fencing within the project area.



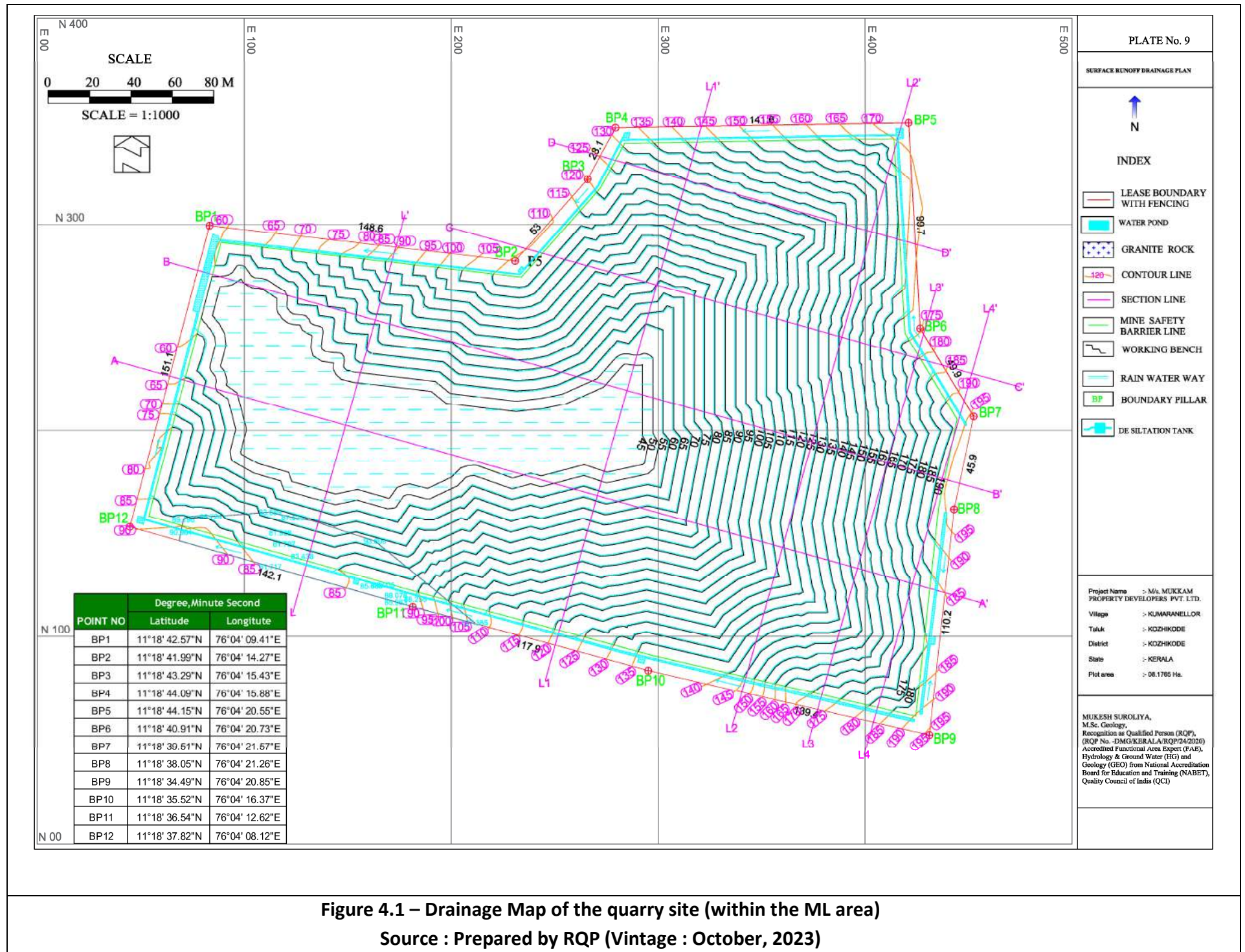


Figure 4.1 – Drainage Map of the quarry site (within the ML area)
Source : Prepared by RQP (Vintage : October, 2023)

Interpretation:-

Garland drains for chanalization of storm water with interceptors (de-silting chambers) proposed.



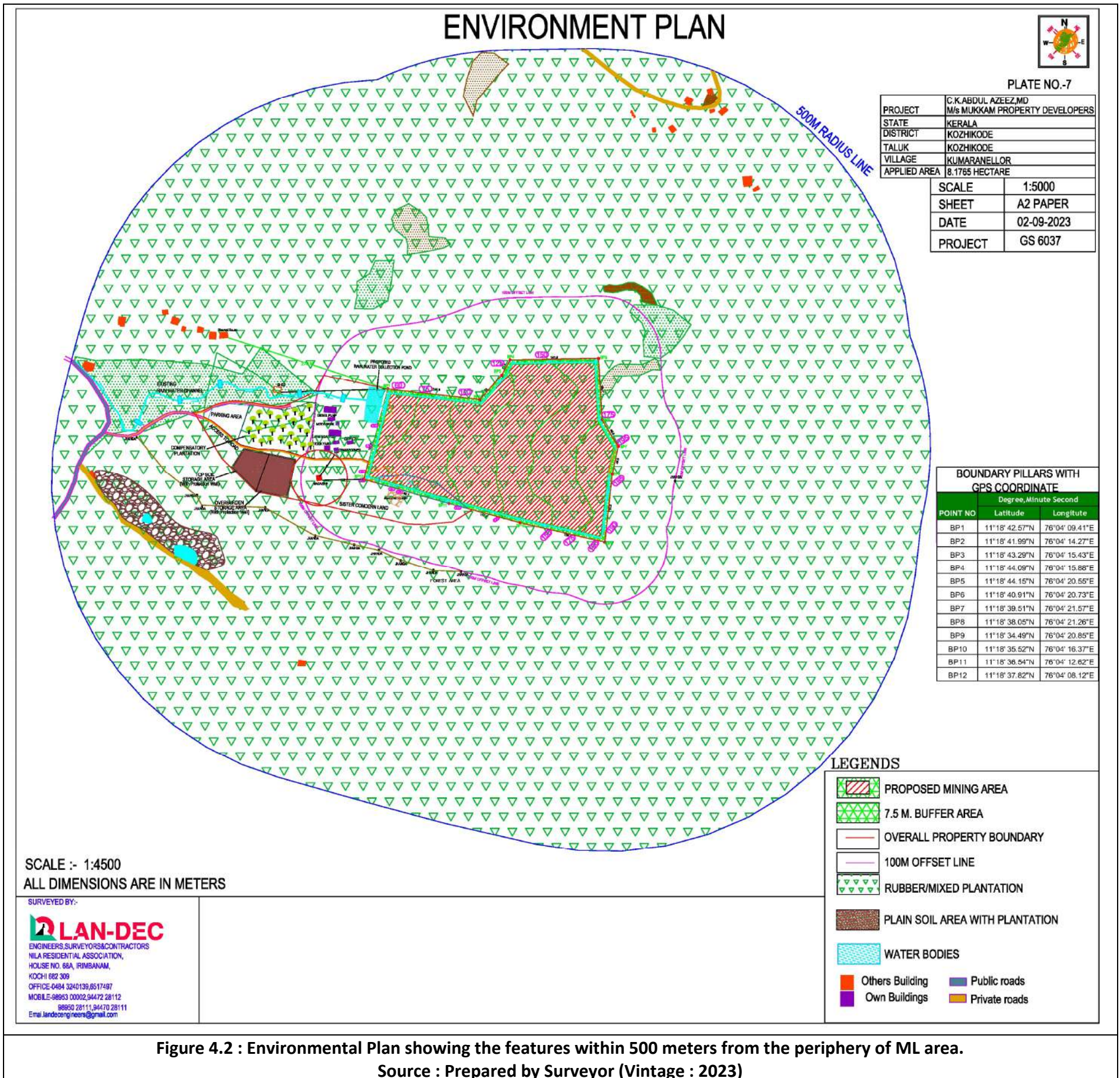
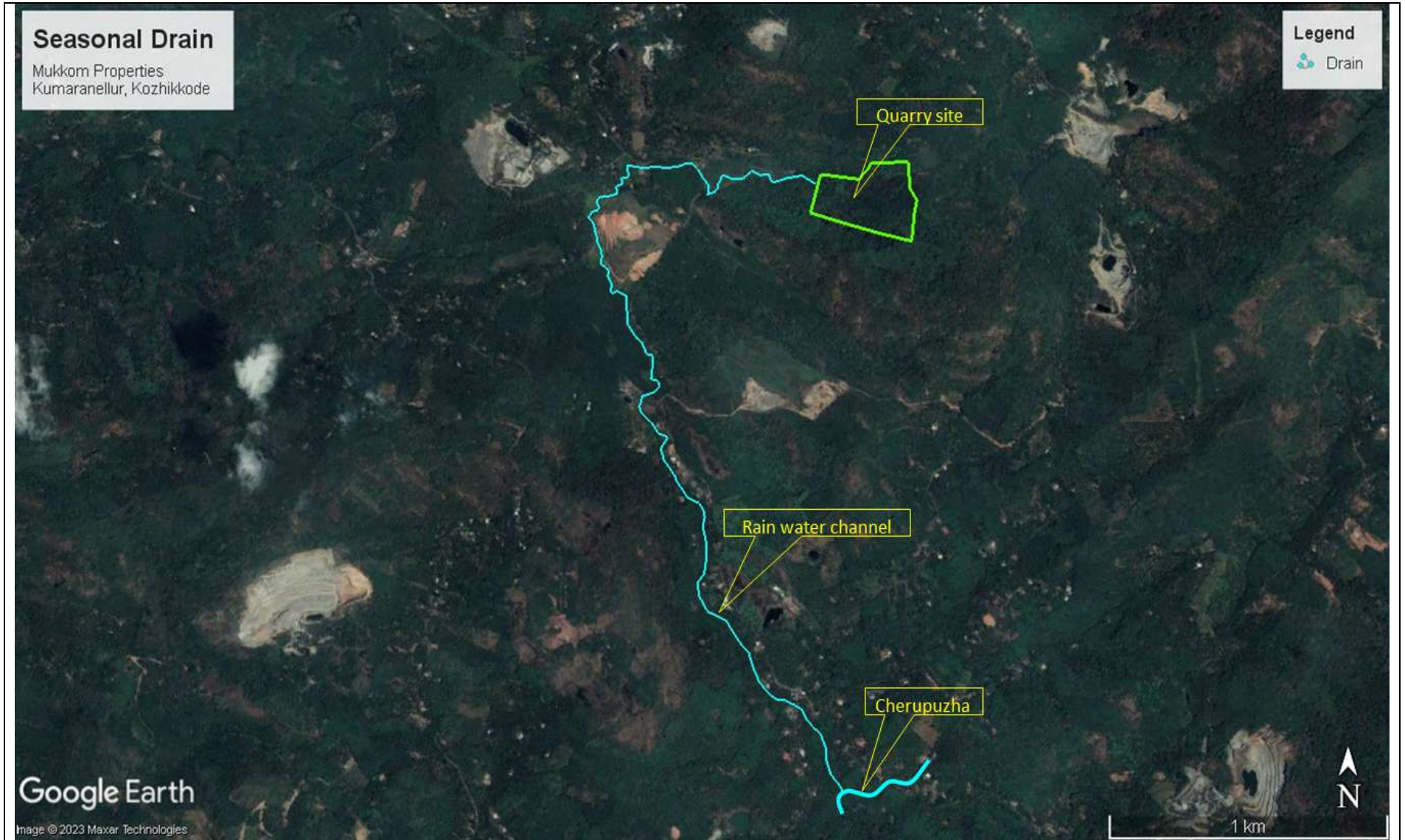


Figure 4.2 : Environmental Plan showing the features within 500 meters from the periphery of ML area.
Source : Prepared by Surveyor (Vintage : 2023)



**Figure 4.3 : Satellite image shown the seasonal drain (ultimate destination of overland flow from the quarry site).
(Source : Extracted from Google map) (Vintage : 2023)**

4.4.3 Mitigation measures for Noise & Vibration impacts :

Noise

Pre-Mining Operation – Mitigation Measures

- Installation of siren / hooters
- Installation of signages / boards around the mine lease area with display of blasting time.

During Mining Operations – Mitigation Measures

- The following engineering **noise control measures** to be adopted for the interruption of the noise path from the source to the receiver.
 - In order to reduce the noise levels during loading and unloading of the mined material, the tippers are provided with rubber lining in the floor of the vehicle body.
 - Selection of new low noise equipment / machineries.
 - Implementation of an effective planned preventive periodical maintenance for all equipment and machineries which is used in the mining site.
 - Blasting to be limited designated hours and the same to be notified for the awareness of people in the vicinity. The blasting should not be carried out during period when school children going & returning in the morning & evening hours.
 - The charge of explosive to be limited as far as possible so as to maintain the noise level and the vibration level as per the predicted values in the nearest habitation.
- The following administrative **noise control measures** to be adopted for the interruption of the noise path from the source to the receiver.
 - Altering the work schedule, moving the personnel further from the noise source.
 - Modifying equipment operation to eliminate or reduce sound.
 - Use of warning signs.
 - Providing personnel hearing protection devices.
- Development of green belt with native species of dense foliage which act as pollution sinks
- The nearest habitation is at about **270 meters** at NW direction of near BP1 and predicted noise levels at distances from the source is within the permissible standards.
- Quarrying operation will be carried out only during day time.



Vibration

Impact of Vibration on nearby houses and built-structures vs Mitigation Measures

[Specific ToR (1) – “*Vibration studies to evaluate the zone of influence and impact of blasting on the neighbourhood as suggested in para (e) of OM No Z -11013/57/2014-IA.II (M) dated 29-10-2014 of MOEF&CC*”]

- The proposed project is a new quarry project and there is no quarrying operations / blasting operations currently at site. Since the quarry operations can be commenced only after obtaining Environmental Clearance and all other statutory approvals, blasting cannot be carried out now for vibration studies. The PP approach Mining & Geology Department for permission to conduct blasting for study purposes but the Department have no provision to permit such pre-mining blasting. Therefore, the PP can not submit primary data on vibration studies to evaluate the zone of influence. Further, it may kindly be noted that there are no built-structures located within 200 meters from the periphery of the proposed mine lease area. In the above referred O.M. dt. 29-10-2014, the minimum set back distance prescribed is 50 meters only. The PP hereby commit that vibration study will be carried out through a national reputed agency within 3 months from the date of commencement of mining operations. The recommendations to be received from the agency who conducts the vibration study will be followed in letter and spirit.
- **Ground vibration** from blasting can be mitigated by the following measures :-
 - The maximum charge per delay will be about 12 kg/blast so as to limit the PPV values to 1.6899 mm/sec. at the nearest built-structure at about 270 meters (As against the permissible 15 mm/ sec.).
 - Divide total charge / blast in several parts so as to keep minimum explosive per delay i.e. use of millisecond delay detonators & relays. Or in other words controlled blasting techniques (**NONEL method**) will be adopted.
 - Careful design of blast hole drilling pattern with appropriate burden distance, spacing as holes, hole-depth, and stemming height.
 - Optimum delay sequence and stem to column ratio would be maintained to minimize the fly rock distance and ground vibration intensity.



- Avoiding blasting in unfavorable weather conditions and conduct blasting at prefixed and well advertised timings.

4.4.4 Mitigation Measures for Ecological Environment :

[Specific ToR (2) – “Study the Impact on Forest and Wild Life”]

Pre-Mining Operation – Mitigation Measures

- Identification of suitable location outside mine lease area for compensatory afforestation (transplantation of tree saplings of endemic species) located within the mine lease area. An area of about 0.82 ha. (10% of ML area of 8.1765 ha.) outside the ML area is earmarked for compensatory afforestation and the tree plantation will be initiated before the commencement of mining operation.
- Fodder for the herbivorous animals will be cultivated outside the ML area and nearby the area abutting the forest land in south & east direction so as to restrict the animal entry in the ML area.
- Invasive alien species found in the ML area (list provided below) need to be cut from the root and to burn it. Burning of invasive species is necessary due to its impact on local species of crops / agriculture. The details of invasive species found in the ML area is given below :-

Details of Invasive Species found in the ML area

S.N.	Botanical Name	Common Name	Type
1	<i>Lantana camara</i> L.	Kongini	Shrubs
2	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Communist-pacha	Shrubs
3	<i>Hyptis suaveolens</i> (L.) Poit.	Nattapoochedi	Shrubs
4	<i>Colocasia esculenta</i> (L.) Schott	Chembu	Herb
5	<i>Senna tora</i> (L.) Roxb.	Thakara	Herb
6	<i>Pueraria phaseoloides</i> (Roxb.) Benth.	Thotta-payar	Climber
7	<i>Mikania micrantha</i> Kunth	Vayara	Climber

- The PP has committed to contribute fund to the Forest Department for avoid occurrence of forest fire and also for removal of alien invasive species within the forest area.
- In the area where the project site is abutting the forest, tree saplings or through other propagation measures in consultation with Forest Department, plantation of species found in the forest area will be developed. In other words, by this measure, eco-restoration of the area currently used as a plantation is ensured.



- The PP has committed to install hanging solar fencing in consultation with Forest Department in the area abutting the forest land in the east and south direction so as to restrict animals in the ML area.
- The commonly found mammals in the project site and the surroundings are Indian Porcupine, Indian Wild Boar, Bonnet Macaque, Common mongoose and which damages the crops in the vicinity and is a type of man-animal conflict. To mitigate this, native species of fruit bearing trees Banana (Vazhapazham), Greater yam (Kachil), Tapioca (Kappa), Colocasia (Chembu), Elephant Foot Yam (Chena), Sweet Potato (Madhura kizhangu) and grass species such as Tropical Carpet Grass, Indian Muraina Grass, Black spear grass, Chrysopogon asper. etc. and also fodder exclusively for the herbivores animals will be planted in the area owned by the PP abutting the forest area.

During Mining Operation – Mitigation Measures

- Buffer area of 7.5 meters (0.8982 ha.) will be maintained all around the lease area and will be maintained as green area development (about 800 trees). In the 7.5 meter buffer area of 0.8982 ha., (total about 800 trees in each row, total two rows) and 5.6902 ha. reclamation area by plantation of 2,250 trees during conceptual stage will be planted in eco-restoration area are to be planted as part of green area development. The plantation plan is provided below at Table 4.5 and yearwise plantation map is provided at Figure 4.4.
- The saplings of endemic species identified in the core zone to be replanted in the area outside the mine lease area marked as compensatory afforestation area to be earmarked in the land owned by the project proponent. The propagation measures of endemic species is provided below at Table 4.6.
- Only native trees will be adopted for green area development. The trees for green area development includes fruit bearing, flowering and shady trees.
- The cutting of trees will be carried out in phases as per the developmental plan.
- Since there are various medicinal shrubs and herbs in the ML area, a medicinal garden will be developed in the area adjoining the mine lease area.
- Plantation will be carried out in the benches which is mined out earlier.
- The suggested species of shrubs / trees for green area development is given below at Table 4.7.



- A butterfly garden is proposed outside ML area. The species to be planted is provided at Table 4.8.

Table 4.5 - Plantation plan

Planting Year	Trees to be cut from ML area	Trees to be planted in core area	Trees to be planted in Buffer & compensatory afforestation area
Before the commencement of mining	0	0	250
1 st year (190-160)	150	6 months grass & herbs	250
		6 months shrubs	
2 nd year (155 - 150)	150	235	Maintenance of planted trees
3 rd year (145-140)	100	150	
4 th year (140-135)	100	90	
5 th year (130-125)	100	205	
6 th year to 21 st year (125-45)	1043	1570	
Sub-Total	1,643	2,250	800 + 820
Total		3,870 say 3,900	

Post-Mining Operation – Mitigation Measures

- Total of about 3,900 trees will be planted in eco-restoration area are to be planted as part of green area development.
- In compliance to O.M. dt. 16-01-2020 of MoEF, grassing of ML area as part of eco-restoration.
- Green belt development during eco-restoration in PMCP by plantation of the species as per the time schedule suggested below :-
- First Six months - Herbs & grass
- Next Six months - Shrubs
- Next Six month onwards - Trees



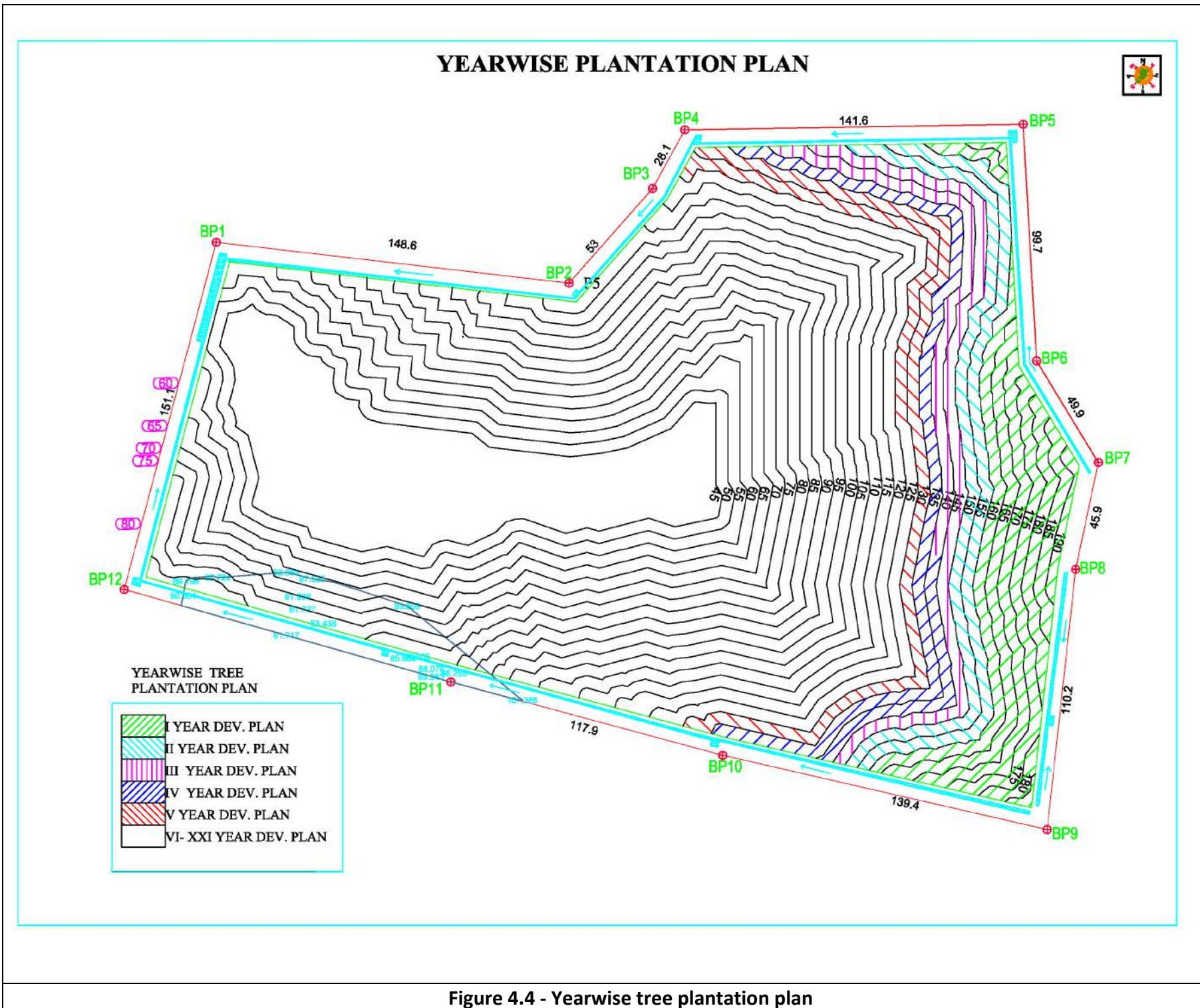


Table 4.6 - List of Endemic plant species observed from the proposed mining area and its Natural/Commercial Propagation procedures

Sl. No.	Botanical Name	Endemism	Propagation Methods	Remarks
1	<i>Tabernaemontana alternifolia</i> L.	Endemic to the Western Ghats	Seed propagation, cuttings and divisions of old rootstocks	Tree sampling
2	<i>Artocarpus hirsutus</i> Lam.	Endemic to Southern Western Ghats	Seed propagation, grafting	Tree sampling
3	<i>Naregamia alata</i>	Endemic to Peninsular India	Seed propagation	Herbs
4	<i>Torenia bicolor</i> Dalz.	Endemic to Western	Seed propagation	Herbs
5	<i>Calamus hookerianus</i>	Endemic to Western Ghats	Seed propagation	Climber

Table 4.7 - Species of native plants suggested for plantation in the area earmarked for green belt and also during mine closure.

SN	Trees	
	Scientific Name	Common Name
1	<i>Tabernaemontana alternifolia</i> (Recorded from the project area)	Kunnanpala
2	<i>Michelia nilagirica</i>	Vellachembakam
3	<i>Artocarpus heterophyllus</i> (Recorded from the project area)	Plavu
4	<i>Briedelia retusa</i>	Mulluvenga
5	<i>Ficus racemosa</i>	Athi
6	<i>Terminalia paniculata</i>	Maruth
7	<i>Xylia xylocarpa</i> (Recorded from the project area)	Irul
8	<i>Syzygium cumini</i>	Njaval
9	<i>Mangifera indica</i> (Recorded from the project area)	Mavu
10	<i>Holarrhena pubescens</i>	Kudagapala
11	<i>Azadirachta indica</i> Adr. Juss.	Aryaveppu
12	<i>Cananga odorata</i>	Kanangamaram
13	<i>Michelia champaca</i>	Chembakam
14	<i>Wrightia tinctoria</i> R.Br (Recorded from the project area)	Dandappala



15	<i>Artocarpus hirsutus</i> Lam (Recorded from the project area)	Anjili
16	<i>Alstonia scholaris</i> (L.) R. Br. (Recorded from the project area)	Ezhilampala/Devil Tree
17	<i>Schleichera oleosa</i>	Poovam
18	<i>Mimusops elengi</i> L.	Elenji/ Asian bullet wood
19	<i>Grewia tiliifolia</i>	Chadachi
20	<i>Mallotus philippensis</i> (Lam.) Muell.-Arg. (Recorded from the project area)	Kapila
Shrubs		
SN	Scientific Name	Common Name
1	<i>Bambusa bamboosa</i>	Mula
2	<i>Helicteres isora</i> (Recorded from the project area)	Edampiri valampiri
3	<i>Sida rhombifolia</i> (Recorded from the project area)	Kurunthotti
4	<i>Pseudarthria viscida</i>	Muvvila
5	<i>Justicia adhatoda</i>	Aadalodakam
6	<i>Ixora coccinea</i> (Recorded from the project area)	Thechi
7	<i>Artabotrys hexapetalus</i>	Manoranjini, Madanapoo
8	<i>Melastoma malabathricum</i>	Athirani
9	<i>Mussaenda frondosa</i> L. (Recorded from the project area)	Vellila
10	<i>Artabotrys zeylanicus</i>	Manoranjini

Table 4.8 - Site specific list of Butterfly's Larval Host Plant, Alkaloid Plants and Nector Plants to be planted during Eco restoration of the quarry to attract Butterflies

SN	Scientific Name	Larval Host plant	Alkaloid Plant	Nector Plants	Remarks
1	<i>Pachliopta hector</i>	<i>Aristolochia indica</i> , <i>A. bracteolata</i> , and <i>Thottea siliquosa</i> (Family Aristolochiaceae)			
2	<i>Pachliopta aristolochiae</i>	<i>Aristolochia bracteolata</i> <i>Aristolochia indica</i> <i>Aristolochia tagala</i> <i>Aristolochiae griffithi</i> <i>Thottea siliquosa</i>			Mud-puddling
3	<i>Papilio clytia</i>	<i>Alseodaphne semecarpifolia</i> ,			Mud-



		<i>Cinnamomum camphora, C. macrocarpum, C. malabathrum, C. tamala, C. verum, Litsea deccanensis, L. glutinosa, Persea gamblei, Ocotea lancifolia, Sarcosperma arboretum etc.</i>			puddling
4	<i>Papilio polytes</i>	<i>Aegle marmelos, Atalantia racemosa, C. aurantiifolia, C. maxima, C. limon, C. medica, Clausena anisata, Glycosmis pentaphylla, Murraya koenigii, M. paniculata, Ravenia spectabilis, Zanthoxylum rhetsa etc.</i>		<i>Lantana, Jatropha, Ixora, and Mussaenda, Asystasia, Peristrophe, and Jasminum,</i>	Mud- puddling
5	<i>Papilio polymnestor</i>	<i>Garcinia xanthochymus, Atalantia racemosa, Atalantia wightii, Citrus maxima, Citrus limon, Glycosmis pentaphylla, Murraya koenigii, Paramignya monophylla etc.</i>			Mud- puddling
6	<i>Graphium agamemnon</i>	<i>Annona glabra, Annona muricata, Annona squamosa, Artabotrys hexapetalus, Desmos chinensis, Goniothalamus cardiopetalus, Miliusa tomentosa, Mitrephora heyneana etc.</i>			
7	<i>Troides minos</i>	<i>Aristolochia indica, Aristolochia tagala, Thottea siliquosa and Bragantia wallichii</i>		<i>Lantana, Ixora, and Mussaenda,</i>	
8	<i>Papilio demoleus</i>	<i>Cullen corylifolium, Ziziphus jujube, Acronychia pedunculata, Aegle marmelos, Chloroxylon swietenia, Citrus aurantiifolia, Citrus maxima, Citrus sinensis etc.</i>			Mud- puddling
9	<i>Eurema hecabe</i>	<i>Acaciaspp., Aeschynomene americana, Senna alata, S. tora, S. obtusifolia, Albizia procera, A. saman, Caesalpinia mimosoides, C. pulcherrima, C. sappan, Cassiaspp., C. fistula etc.</i>			
10	<i>Leptosia nina</i>	<i>Capparis baduicca, Capparis spinosa, Capparis zeylanica, Crateva adansonii, Crateva religiosa</i>			



11	<i>Eurema blanda</i>	<i>Acrocarpus fraxinifolius, Albizia spp., Albizia lebbeck, Bauhinia purpurea, Caesalpinia mimosoides, C. regia, C. sappan, Calliandra calothyrsus, Cassia fistula,</i>			
12	<i>Catopsilia pomona</i>	<i>Bauhinia racemosa, Butea monosperma, Cassia fistula, Dalbergia latifolia, Senna tora, S. siamea, Sesbania grandiflora etc.</i>			
13	<i>Tirumala septentrionis</i>	<i>Vallaris dichotoma, V. heynei (Family Apocynaceae), Cosmostigma racemosa, and Wattakaka volubilis (Family Asclepiadaceae).</i>			
14	<i>Elymnias hypermnestra</i>	<i>Areca catechu, Calamus rotang, C. pseudofeanus, C. thwaitesii, Arenga engleri, A. pinnata, A. wightii, Caryota urens, Chamaerops humilis, Dypsis lutescens, Cocos nucifera, Elaeis guineensis, Livistona chinensis etc</i>			
15	<i>Euploea core</i>	<i>Adenium obesum, Asclepias curassavica, Carissa carandas, C. spinarum, Cascabela thevetia, Cryptolepis dubia, C. sinensis, Hemidesmus indicus, Holarrhena spp., Ichnocarpus frutescens, Nerium spp., Nerium oleander,</i>	<i>Crotalaria and Heliotropium</i>		Mud-puddling
16	<i>Neptis hylas</i>	<i>Bombax ceiba, Hevea brasiliensis, Canavalia ensiformis, Canavalia gladiata, Flemingia spp., Lathyrus spp., Mucuna purpurea, Paracalyx spp., P. scariosus, Rhynchosia spp., Vigna cylindrica, V. unguiculata, Xylia xylocarpa etc.</i>			
17	<i>Hypolimnasia bolina</i>	<i>Abutilon sp., Hibiscus sp., Arrowleaf Sida Sida rhombifolia (Family Malvaceae), Common Purslane Portulaca oleracea (Family Portulacaceae), Elatostemma cuneatum, Hen's Nettle Laportae interrupta (Family Urticaceae).</i>			
18	<i>Euploea</i>	<i>Hoya sp., Cynanchum sp. (Family</i>			



	<i>sylvester</i>	Asclepiadaceae, Milkweeds), <i>Ichnocarpus frutescens</i> (Family Apocynaceae), <i>Ficus microcarpa</i> , <i>Ficus racemosa</i> (<i>F. glomerata</i>), <i>Ficus</i> <i>sp.</i> (Family Moraceae, Figs).			
19	<i>Tirumala limniace</i>	<i>Holarrhena pubescens</i> , <i>Asclepias curassavica</i> , <i>Calotropis gigantean</i> , <i>Calotropis procera</i> , <i>Cosmostigma cordatum</i> etc.			
20	<i>Ariadne ariadne</i>	<i>Ricinus communis</i> , Indian Stinging Nettle <i>Tragia involucrata</i> , <i>T. plukenetii</i> (Family Euphorbiaceae).			
21	<i>Ypthima baldus</i>	Plant species from Poaceae family			
22	<i>Junonia iphita</i>	<i>Barleria cristata</i> , <i>Dipteracanthus prostratus</i> , <i>Hygrophila auriculata</i> , <i>Justicia micrantha</i> , <i>J. neesii</i> , <i>Ruellia elegans</i> , <i>R. simplex</i> , <i>R. tuberosa</i> , <i>R. tweediana</i> , <i>Strobilanthes callosus</i> , <i>S. ciliata</i> , <i>Achimenes grandiflora</i>			
23	<i>Danaus genutia</i>	<i>Asclepias currassavica</i> , <i>Ceropegia sp.</i> , <i>Cynanchum sp.</i> , <i>Marsdenia roylei</i> , <i>Stephanotis sp.</i> , <i>Tylophora tenuis</i> (Family Asclepiadaceae).	<i>Crotalaria</i> <i>a</i> , <i>Heliotropi</i> <i>um</i> , and <i>Eupatori</i> <i>m</i>		
24	<i>Melanitis leda</i>	<i>Poaceae</i> , <i>Apluda</i> , <i>Bambusa</i> , <i>Brachiaria mutica</i> , <i>Coix lacryma-jobi</i> , <i>Cyrtococcum</i> , <i>Digitaria</i> , <i>Eleusine</i> <i>Oplismenus composites</i> , <i>Oryza sativa</i> , <i>Panicum repens</i> <i>Pennisetum glaucum</i> , <i>Pennisetum purpureum</i> , <i>Rottboellia cochinchinensis</i> , <i>Saccharum officinarum</i> , <i>Setaria barbata</i> , <i>Zea mays</i>			
25	<i>Ypthima huebneri</i>	<i>Axonopus compressus</i> , Grass spp. (Family Poaceae).			
26	<i>Mycalesis perseus</i>	<i>Poaceae</i> , <i>Oplismenus composites</i> , <i>Oryza sativa</i>			
27	<i>Parthenos sylvia</i>	<i>Zanonia indica</i> , <i>Tinospora sinensis</i> , <i>Adenia hondala</i>			



28	<i>Jamides celeno</i>	<i>Abrus precatorius, Cajanus albicans, Butea monosperma, Phaseolus adenanthus, Pongamia pinnata, Saraca asoca, Xylia xylocarpa, Heynea trijuga, Trichilia hirta, T. trijuga, Elettaria cardamomum</i>			
29	<i>Prosotas nora</i>	<i>Mallotus philippensis, Acacia caesia, Acacia catechu, Acacia torta, Mimosa invisa, Pithecellobium dulce, Allophylus cobbe</i>			
30	<i>Talicada nyseus</i>	<i>Kalanchoe laciniata, Kalanchoe calycinum, K. pinnata, Bryophyllum delagoense, Bryophyllum pinnatum</i>			
31	<i>Castalius rosimon</i>	<i>Ziziphus jujuba, Ziziphus oenopolia, Ziziphus rugosa, Ziziphus xylopyrus</i>			
32	<i>Chilades pandava</i>	<i>Cycas circinalis, Cycas revoluta (Family Cycadaceae), Acacia spp., Xylia xylocarpa (Mimosaceae).</i>			
33	<i>Rathinda amor</i>	<i>Mangifera indica, Meiogyne pannosa, Calophyllum, Hopea Blachia, Croton, Barringtonia acutangula, Careya arborea Loranthus, Eugenia roxburghii Ixora brachiata, Schleichera Quassia indica</i>			
34	<i>Zizina otis</i>	<i>Amaranthus viridis, Alysicarpus vaginalis, Desmodium heterophyllum, Desmodium triflorum, Sesbania bispinosa, Zornia diphylla, Zornia gibbosa, Zornia reticulate, Tribulus terrestris</i>			
35	<i>Udaspes folus</i>	Species of ginger and turmeric including <i>Curcuma aromatica, C. decipiens, C. pseudomontana, Hedychium spp., Zingiber sp.</i> (Family Zingiberaceae). Also on Grasses.			
36	<i>Sarangesa dasahara</i>	<i>Asystasia spp., Blepharis asperrima, Lepidagathis cuspidata</i>			
37	<i>Tagiades gana</i>	<i>Dioscorea alata, Dioscorea oppositifolia, Dioscorea wallichii</i>			
Some butterfly species reported from the proposed quarry site are performing mud-puddling activities. Thus during ecorestoration process prepare a muddy spot and a wet patch inside the					



mined out area to help mud puddling butterfly species. Butterflies (especially males of many species) will visit such damp and muddy places to get their daily dose of water, minerals and various chemicals needed for their physiological needs. This is known as 'mud-puddling'.

4.4.5 Mitigation measures for Socio Economic environment:

Pre-Mining Operation – Mitigation Measures

- Setting up of an office, labour quarter with basic amenities.

During Mining Operation – Mitigation Measures

- The PP has set apart an amount of Rs. 65 Lakhs (about 6% of the project cost) for construction of buildings for Primary Health Care (PHC), Karassery Grama Panchayat.
- Training to locals to develop skill for employment in the mine which includes mining related machinery / equipments etc.
- Provide more employment opportunities to the people in the vicinity. A format is attached as for **Annexure No. 4.1** which will be notified in the Local Body, District Industries Centre (DIC), Employment Exchange.
- Access to potable water for the people in the vicinity during summer months.
- Periodical monitoring of welfare measures to be adopted for the people in project vicinity.
- Support local small scale entrepreneurs for setting up ancillary activities like supply of grocery and other allied engineering activities.
- The PP need to monitor all parameters of water used for domestic purposes of residents in the vicinity from rain water collection pond during summer season by an NABL accredited laboratory once in six months.

4.4.6 Mitigation measures on Air Environment:

4.4.6.1 Paved surfaces

- Regular cleaning of paved surfaces and wetting of the surface.
- Speed controls on vehicle movements (<30 kmph).
- Wind reduction control by way of green area development.

4.4.6.2 Unpaved surfaces

- Water sprinkling on unpaved areas during dry wind periods on regular intervals through a mobile sprinkler unit of 5 KL capacity.
- Re-vegetation / eco-restoration of exposed surfaces.



- Surface improvements to be done with asphalt for stabilization.
- Speed controls on vehicle movements to limit speed.
- Wind reduction control by plantation.

4.4.6.3 Vehicles

- Vehicular emission of particulates, SO₂, NO_x, hydrocarbons can be minimized by proper training and maintenance of vehicles and other oil - operated equipments. Bi-annual emission checking (PUC) for all vehicles plying in core area shall be made mandatory.
- Speeds controls on vehicles.
- Rubber beading arrangement is made in the truck which transport sand and other materials from the crusher so as to ensure no spillages in the road. The only area through which spillage takes place from the vehicle is from the bottom portion of the rear side of the opening and from no other place.

4.4.6.4 Mining activity

- Since the stripping ratio is negligible (1:0.040245), there is no large quantity of handling and transportation of waste materials and therefore, no potential impact on traffic density and emissions associated with it.
- Measures to reduce the emissions of pollutants during drilling by using wet jets (Drilling by Flexi ROC T25 Drill machines),
- Using blast mats before blasting to reduce the dust emission and to reduce the fly rock movement.
- The nearest habitation is located at 270 meter at NW direction of near BP 1. Further, the pre-dominant wind direction is from North West to South East direction. In the east direction of the ML area is hilly slope, therefore, for the proposed quarry site no impact envisaged, there are large scale plantation available and therefore which will work as green barrier.
- Use of appropriate explosives for blasting and avoiding overcharging of blast holes.
- Provision of dust filters / mask / PPEs to mine workers.
- Conducting periodical medical check-up of all workers to know health problems.
- Training to personnel to create awareness
- Green cover over the top soil / overburden dump.



- Compensatory afforestation with native trees of dense foliage to be carried out in an area (outside the ML area) and which will be commenced prior to the commencement of mining.
- Development of green belt all along 7.5 m. buffer (periphery length 1,228 meters) with native species (0.8982 ha.) (about 800 nos. (about 400 trees in one row) of trees, two rows at 3 - 4 m. C/C) will be commenced prior to the commencement of mining.
- Clearing of vegetation in the core zone in phases as per development plan.
- Periodical monitoring of ambient air quality in the core zone.
- The extracted mineral will be transported from the quarry to the crusher by adopting following measures so as to minimize dust emissions.
 - The trucks after loading will be covered with tarpaulin sheets.
 - Speed of the vehicles will be maintained within the prescribed limits.
 - Trucks will not be over loaded and will be maintained to body level.
 - The wetting of materials before transfer of materials.
- Modeling studies (AEROMOD-ISCST3) were carried out to assess the impacts due to the mining operations of proposed quarry and the predicted values of PM₁₀ and PM_{2.5} in the downwind direction is found (**Annexure No. 4.2**). The predicted values are within the permissible ambient air quality standards.

4.4.7 Mitigation measures on Traffic

- A traffic study was carried out to access the current traffic on Maranchatty-Thottumukkam Road (both directions). All the products / material from the proposed quarry reaches the in the surrounding panchayaths of Kozhikode district like Karassery, Thiruvambadi, Koodaranhi, Kodyathur, Chathamangalam, Mukkom and Panchayats located in the Malappuram district which are Urangattiri, Areecode, Cheekode, Keezhuparamba, Vazhakkad etc. for supply to the end users at different locations within the Kozhikode & Malappuram District. The existing roads width located nearby the quarry are sufficient for additional traffic load from the proposed mine.
- The V/C of *Maranchatty-Thottumukkam* Road related to IRC guidelines is referred & it is 0.3.
- After the commencement the proposed mining activities, the traffic from the mine will be able to cater the traffic in *Maranchatty-Thottumukkam* Road.



- The rubble from the proposed mine will be sent to open market / stone crusher units located within 5 to 8 kms from the proposed mine site. The aggregates from the proposed mine will be sold to Calicut Expressway Private Limited for construction of proposed six lining of existing Kozhikkode Bypass (*Vengalam junction to Ramanattukara junction*) as part of infrastructure works.

4.5 Irreversible and Irretrievable commitments of environmental components.

- The commitments under the mining plan will be followed.
- The conditions under the Explosive license will be followed.
- The conditions as per "Consent to Operate" (CTO) will be followed.
- All conditions in Environmental Clearance and other statutory approvals will be followed.



CHAPTER – 5

**ANALYSIS OF ALTERNATIVES
(TECHNOLOGY AND SITE)**

5.0 ANALYSIS OF ALTERNATIVES (TECHONOLOGY AND SITE)

(In case, the scoping exercise results in need for alternatives)

Appendix-III of EIA Notification, 2006 (Generic Structure of Environmental Impact Assessment Document), for Chapter-5 it is stated that "Analysis of Alternatives" arises in case the scoping exercise results in need for the same. In the instant project of cluster EIA, there was no discussion or requirement for "Analysis of Alternatives" by the Expert Appraisal Committee (EAC) / State Expert Appraisal Committee (SEAC) at the scoping stage of the proposal. In the instant project, since the SEAC, Kerala has not prescribed for such a study during the scoping stage and hence not part of the EIA Report.



CHAPTER – 6

**ENVIRONMENTAL MONITORING
PROGRAM**

6.0 ENVIRONMENTAL MONITORING PROGRAM

Introduction

The Environmental Monitoring Program provides such information on which lessee will take decision during mine planning and operation phases. It provides basis for evaluating the efficiency of mitigation and pollution control measures and suggest further actions that need to be taken to achieve the desired effect as part of adaptive management.

The monitoring includes:-

- (i) Visual observations;
- (ii) Selection of environmental parameters at specific locations;
- (iii) Sampling and regular testing of these parameters for different facets of environment.

6.1 Technical aspects of monitoring the effectiveness of mitigation measures (incl. Measurement methodologies, frequency, location, data analysis, reporting schedules, emergency procedures, detailed budget & procurement schedules)

6.1.1 Objectives

The objectives of the environmental monitoring program are:

- Evaluation of the efficiency of mitigation and pollution control measures / equipments / devices ;
- Updating of the actions and impacts of baseline data;
- Adoption of additional mitigation measures if the present measures are insufficient;
- Generating data, which may be incorporated in environmental management plan in future projects.

6.1.2 Methodology

Monitoring methodology covers the following key aspects:

- Components to be monitored;
- Parameters for monitoring of the above components;
- Monitoring frequency;
- Monitoring standards;
- Responsibilities for monitoring;
- Direct responsibility;
- Overall responsibility;



- Monitoring costs.

Environmental monitoring of the parameters involved and the threshold limits specified are discussed below.

6.1.3 Fréquence and location

Soil Monitoring

The soil sample quality in the core zone and buffer zone will be carried out once in a year.

Water Quality Monitoring

The physical, chemical & bacteriological parameters recommended for analysis of water quality will be carried out once in six months as per IS:10500 for well water within 500 meters from the core zone and the nearest surface water body in the downstream.

Noise Level Monitoring & Vibration

The measurements for monitoring noise levels would be carried out at all sensitive locations near to the mine lease area in the buffer zone, once in three months.

The vibration level shall be measured as per the assessment criteria given under Bureau of Indian Standard, once in year.

Ecological Environment Monitoring

The ecological assessment of the core zone and the buffer zone to be carried out once in 2 years.

Socio-economic Environment Monitoring

The socio-economic profile and the changed social profile of the buffer zone due to the mining activity are to be carried out once in 3 years.

Occupational Health frequency and location

- Quarrying operations should have some form of occupational health program in place.
- Occupational health is about protecting the physical and mental health of workers and ensuring their continual welfare in their working environment. In addition to preventing ill health, other important aspects of occupational health include:
 - ✓ Ensuring fitness and physical capability to perform a job safely
 - ✓ Health education and promotion
 - ✓ Providing medical services including health surveillance
 - ✓ Rehabilitation after illness or injury.



- Recruitment of employees shall be based on the skill set requirement of specific trade in the mining activity ranging from supervision to manual work.
- All employees undergo health monitoring during recruitment and periodically during employment depending on the age of employee. During operation of mine, the health monitoring of workers shall be done as per the guidelines of DGMS.
- All employees will be provided with personal protective equipment depending on the trade, ranging from helmets, safety shoes, dust masks, safety goggles, gloves, ear plugs and ear muffs.
- The employees are made aware of the hazards related all mining activities and transportation of aggregate and the occupational safety practices to be adopted to ensure safe work environment. The frequency of health monitoring and type of evaluation is presented in the following table 6.1;

Table 6.1 - Cost Estimate (Budgetary provisions) for Health monitoring

S. N.	Particular	Capital Cost (in Rs)	Recurring Cost (in Rs)
1	Medical check-up for all workers for lung function, audiometric test, tuberculosis and pulmonary disease	6,00,000/-	6,00,000/-
2	Provision for free medicines for all workers	50,000/-	50,000/-
3	Provision for personal protection equipment like ear plug, dust mask, shoes, goggles.	1,00,000/-	50,000/-
4	Provision for First Aid facilities	50,000/-	10,000/-
	Total	8,00,000/-	7,10,000/-

Ambient Air Quality (AAQ) Monitoring

Ambient air quality parameters recommended are Particulate Matter (size less than 10µm) or PM₁₀, Particulate Matter (Size Less than 2.5µm) or PM_{2.5}, Oxides of Nitrogen (NO₂) and Sulphur Dioxide (SO₂) , Carbon Monoxides (CO) & Lead (Pb). These parameters are to be monitored at designated locations (as explained in Chapter 3, core zone and buffer zone at sensitive locations) starting from the day of operation of mining activity once in six months. The monitoring will be carried out as per the methodology as per Central Pollution Control Board (CPCB).



6.1.4 Environment Monitoring Plan

The detailed Environment Monitoring Plan is presented in the Table 6.2.

Table 6.2 - Environmental Monitoring Plan

Sr. No.	Particulars	Monitoring Frequency	Standards	Duration of Sampling	Important monitoring parameters
Soil Quality Monitoring					
1	Two Soil samples from core zone and Two soil sample in the buffer zone.	Once in a year	"EIA guidance manual on mining of minerals"		Parameters for monitoring as explained in Chapter 3
Water Quality Monitoring					
1	At 2 locations (2 ground water sample within 500m and 2 surface water sample in the downstream)	Once in 6 months	As per IS:10500		Parameters for water quality referred in Chapter 3
2	Hydro-geological study	Once in three years	As per CGWA guidelines		Depth of ground water table, referred in Chapter 3.
Noise Level & Vibration Monitoring					
1	Noise level at 6 locations (sensitive receptors in the buffer zone)	Once in three months	Noise standards by CPCB	24 hrs.	Equivalent Noise levels in dB(A)
2	Vibration study	Once in a year	DGMS standard	-	-
Ecological Environment					
1.	Ecological assessment study	Once in two years			1. Flora, fauna (terrestrial & aquatic) including zoo plankton, phyto plankton and benthos. 2. Survival of sapling plants.



Socio-economic Environment					
1.	Socio-economic profile of the buffer zone	Once in three years			Demographic profile, Health status
2.	All employees in the mine and in the immediate vicinity	I. At the time of recruitment II. Every years to all age group			Chest X-ray, spirometry and vision testing, Far & near Vision; Colour Vision; and Hearing tests
Ambient Air Quality Monitoring					
1	At 6 locations, One sample at Core Zone & other 5 samples in the Sensitive locations within the 2 kms from the ML area. (Total 6 samples)	Once in six months	Air (Prevention and control of Pollution) Rules, CPCB 1994	24 hrs.	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , CO, Pb

6.1.5 Responsibility of monitoring and reporting system including monitoring of the performance of pollution control devices proposed

The overall responsibility of monitoring the above parameters lies with the environmental cell and the management. The Environmental Officer shall be responsible for day to day monitoring. The monitoring shall be conducted either by NABL accredited laboratory or by MoEF&CC approved laboratory. Also, the Environmental Officer would be monitoring of the performance of pollution control devices proposed and appropriate steps needs to get the performance efficacy of the pollution control devices.

Records shall be maintained for the analysis of well water, ambient air quality data and noise levels etc. These records are not only required for the perusal of the Pollution Control Board / SEIAA / MoEF&CC / authorities but also to derive at the efficiencies of the pollution control measures as the objective of the project proponent is not only compliance with statutory regulations, but also a serious commitment towards clean environment and sustainable mining operations. The management shall maintain the records as per the hazardous waste regulations and EPA regulations and apply for the annual consents under Air Act and Water Act.



Reporting system provides the necessary feedback for project management to ensure quality of the mitigation measures and that the management plan in implementation. The rationale for a reporting system is based on accountability to ensure that the measures proposed as part of the Environmental Management Plan get implemented in the mining area. The hierarchy of reporting is that the Environmental Officer will report any non compliance to the Mines Manager and to the project proponent (lessee).

6.1.6 Environmental Monitoring Budget

The budget for environmental monitoring for the parameters mentioned in Table 6.2 is calculated on the basis of CPCB notification of charges for environmental monitoring and analysis. The cost estimate for environmental monitoring is presented in Table 6.3.

Table 6.3 - Environmental Monitoring Budget

SN	Component	Item	Unit	Unit Cost (Rs.)	Total Cost / Year (Rs.)
1	Soil	5 locations specified in monitoring plan	Once in a year	4,000/-	20,000/-
2a	Water quality	4 locations specified in monitoring plan	Once in 6 months	8,000/-	32,000/-
2b	Hydrogeology	Within 1 km radius of the core zone.	Once in three years	60,000	20,000/-
3a	Noise	6 locations	Once in 3 months	1,200/-	28,800/-
3b	Vibration study	Vibration level near to the human habitation	Once in a year	1,50,000/-	1,50,000/-
4.	Ecological assessment	In the buffer zone	Once in two years.	1,00,000/-	50,000/-
5a	Socio-economic assessment	In the buffer zone	Once in three years	60,000/-	20,000/-
5b	Health check-up	As per the age groups of the employees of the mine lease	Once in year	---	8,00,000/-



6	Air	Ambient Air Quality at 6 locations	Once in 6 months	6,000/-	72,000/-
Total Amount					11,92,800/-



CHAPTER – 7

ADDITIONAL STUDIES

7.0 ADDITIONAL STUDIES

This chapter broadly looks at various aspects related to Public Consultation, Risk Assessment & Disaster Management, Social Impact Assessment and Rehabilitation & Resettlement (R&R) Action Plans.

7.1 Public Consultation

The project proponent is required to conduct public consultation as per EIA Notification, 2006 since the proposed ML area is more than 5 ha, public consultation is a mandatory requirement under the provisions of EIA Notification, 2006.

Public consultation refers to the process by which the concerns of local affected persons and others who have plausible stake in the environmental impacts of the mining activity with a view to take into account all the material concerns which are appropriate. The public hearing for the instant project shall be conducted by the Kerala State Pollution Control Board with the consent of District Magistrate as envisaged under EIA Notification, 2006. The salient features of the draft EIA Report by way of an executive summary both in English language and in Malayalam language will be displayed and distributed to all the local people in the vicinity. The minutes of public hearing will be sent to the regulatory authority by the pollution control board for their consideration before a final decision is taken regarding grant of Environment Clearance for the proposed quarry project. The replies to the concerns of the public raised during public hearing are to be incorporated in the final EIA report. Since the EIA study is conducted and therefore a public consultation is proposed by the project proponent.

7.2 Risk Assessment & Disaster Management

7.2.1 Objectives and Scope

Risk analysis has been carried out to identify the activities and materials considered hazardous and to prepare the emergency and disaster management plan for the hazards and risks anticipated from open cast mechanized mining activity for building stone mining activity. The risk assessment involves hazard identification, hazard analysis followed by disaster management plan for the identified hazards.

7.2.2 Mining Activity

The proposed quarry has obtained a Letter of Intent (LOI) for the proposed area from Department of Mining & Geology, Govt. of Kerala. The mechanized mining activity involves pre-mining activities like construction of garland drain, secured storage area for top soil / over



burden, construction of rain water storage pond, etc. and site clearance, construction of haulage road, removal of top soil / overburden and transportation, drilling, blasting, excavation, loading and transportation of mineral and wastes as mining activities. The services required for the mining activity are construction of office, labour shed, restroom, toilets, magazine for storage of explosives, accommodation for mine workers etc. The mine lease area is spread over a hillock. The top soil and overburden waste will be stored at the earmarked area outside the ML area, land owned by the project proponent. The explosive magazine will be installed at the quarry site attached to the proposed quarry. The hazards involved and its management in a open cast mining project is provided in the following table.

Table 7.1 – Causes of Disaster and Management Plan

Sr. No.	Causes of disaster	Management plan
1.	Failure of lightening arrestor at Magazine	Frequent checking
2.	Failure of heavy machinery	Frequent checking about its worthiness
3.	Accidents due to drilling and blasting	Drilling and blasting is to be carried out under the supervision of Mines Manager and with trained personnel only
4.	Rupture of the compressed air pipe	Frequent engineering check about the quality of pipe
5.	Improper handling of explosives	Explosives are to be handled only by the people who are authorized to handle
6.	Side wall collapse	Necessary protection measures like retaining wall / ge textile / hydro seeding etc.
7.	Fly rock from blasting	Use of blast mats

7.2.2.1 Blasting Hazards

Blasting in mining areas may give rise to ground vibrations. Fly rock is another problem that deserves attention. Based on the ground vibration studies made earlier, proper precautions will be taken during blasting operations for controlling the ground vibrations. The management plan for addressing the various impacts due to blasting operations is presented below.



7.2.2.2 Blast vibrations and control measures

Controlled blasting (NONEL) technique will be adopted in this project in order to reduce blast vibrations. Further, charge per delay will be regulated to minimize blast vibrations. Proper hook-up will be adopted while firing the drill holes. Moreover the experience gained in other open cast mines would be gainfully utilized to limit the ground vibration levels within the prescribed limit of 15 mm/sec (as per DGMS). In addition, the following guidelines will be adopted wherever required to check the ground vibrations:-

- The maximum charge per delay will be about 12 kg/blast for the project so as to limit the PPV values to 1.6899 mm/sec. (As against the permissible 15 mm/ sec.).
- Optimum delay sequence and stem to column ratio will be maintained to minimize the fly rock distance and ground vibration intensity.
- Basing on the distance of the nearest sensitive areas from the epicenter of the blast, charge weight will be altered to meet the stipulated standards.
- Design of optimum blast hole geometry considering bench height, diameter of hole, type of explosive, nature of rock, level of fragmentation required etc.
- Divide total charge/ blast in several parts so as to keep minimum explosive per delay i.e. use of millisecond delay detonators & relays.
- Avoid concentration of explosive by using deck charging.
- Avoiding blasting in unfavorable weather conditions.
- Use of **NONEL** method blasting techniques
- Use of **Blast mats**.

7.2.2.3 Fly Rock control measures

There are a large number of factors that influence fly rocks. Most important of these factors are long explosive columns with little stemming at the mouth of the hole, irregular shape of face, long water column in holes, loose stones on face of the surface blasting area, and strong wind. However, certain preventive measures will be taken to minimize the risks arising from flying fragments. These are:-

- **Marking of danger zone:-** The area falling within 250 m of the blasting area will be marked off as danger zone with red flags, or other appropriate signs, and entry of any unauthorized person into this zone will be prohibited during blasting operation.



- **Warning signals:-** An audible warning signal / siren will be given, fifteen minutes before actual firing of blast to enable persons to move out of danger zone. For this purpose, a set of sirens/ hooters will be provided at appropriate places.
- Employing of manpower in the vicinity up to 250 m from the area of blasting and blasting will be carried out only designated hours.
- **Providing blasting shelters:-** In order to protect the personnel engaged in blasting operations, blasting shelters will be provided for taking shelter during blasting.

7.2.2.4 Air Blast control measures

The release of explosive energy through air and movement of fragmented rocks are primary causes for noise and air over pressure during blasting.

Adoption of following measures while carrying out blasting operation will help in reducing the intensity of air blasts and will also minimize the noise level associated with the air blasts. The measures suggested are:-

- Avoiding overcharging of blast holes
- Adequate stemming
- Maintaining proper inter-hole & inter-row delays.

7.2.3 Risk Assessment and Disaster Management Plan

7.2.3.1 Fall of Sides

- Flatter slopes angles are adopted where occurrences of loose earth are encountered.
- No disaster like land slide, flood or inundation or fire is anticipated in this case.
- Unmanageable heights are not created.
- Loose rocks will be properly dressed.
- Nature and structure of the rocks are properly studied for their slips.
- The faces will slope at 70°.
- The hanging wall, footwall, and mineralized zone are competent to stand safely for long time.

7.2.3.2 Storage and use of explosives

- Proper and safe storage of explosives in approved and Licensed Magazine.
- Proper, safe and careful handling and use of explosives by competent Blasters having Blaster's Certificate of Competency issued by DGMS.



- Proper security system to prevent theft/ pilferage, unauthorized entry into magazine area and checking authorized persons to prevent carrying of match box, lights, mobile phones, cigarette or beedi, etc.
- The explosives of class 2 will be used in their original cartridge packing and such cartridge shall not be cut to remove explosive for making cartridge of different size.
- Detonators will be conveyed in special containers. These will not be carried with other explosives.
- The holes which have been charged with explosives will not be left unattended till blasting is completed.
- Before starting charging, clear audible warning signals by Sirens will be given so that people nearby can take shelter.
- Blasting operations will be carried out in day times only. However, in this project the mining operations are proposed to be carried out in day times.

7.2.3.3 Storage of oil, fuel & used oil

- Due care will be taken to avoid oil spillage.
- Storage will not be allowed beyond necessity.
- Fuel oil and lubricants will be stored only in approved containers in separate store rooms. Match box, lighters, mobile phone, dry wood, plastic paper sheets and smoking will not be allowed near the storage area.
- Spent oil from diesel engines are stored separately and is disposed off as per the Hazardous Waste Management Rules.

7.2.4 Disaster Management Plan

During mining activities, proper measures will be taken to ensure safety at site. In order to handle disaster / emergency situations, an organizational chart entrusting responsibility to various project personnel will be prepared with their specific roles during emergency.

The possible composition of the management team shall be:-

1. Mines Manager
2. Environmental Officer
3. Personnel/Administrative Manager
4. Transport Coordinator



5. Medical Coordinator

7.2.4.1 Infrastructure

Following infrastructure and operational system will be provided to meet any emergencies.

7.2.4.2 Emergency Control Room

This will be situated in an area away from the places of fire and will be provided with the following facilities:-

- a. Master plan of the mines.
- b. First aid boxes.
- c. Gas masks.
- d. Telephone line facility.
- e. Loud hailers.
- f. Emergency lighting system.
- g. Stretchers.
- h. Transport facility.
- i. Emergency control room will function as control base
- j. Number of mining workers and a map showing their location to be deployed.

7.2.4.3 Assembly Points

Assembly points are to be set up farthest from the location of likely hazardous events, where pre-designated persons from the works, contractors and visitors would assemble in case of emergency. Up-to-date list of pre-designated employees of various departments must be available at these points so that roll call could be taken. Pre-designated persons would take charge of these points and mark presence as the people come into it.

7.2.4.4 Communication System

Different types of alarms to differentiate types of emergencies will be provided.

7.2.4.5 Warning System and Control

The Control Centers will be located at an area of minimum risk or vulnerability in the premises concerned, taking into account the wind direction, areas which might be affected by fire/explosion, toxic releases, etc. For promptness and efficiency, the premises/storage sites may be divided into number of zones, which should be clearly marked on the site plan.



7.2.4.6 Emergency Services

This includes the fire-fighting system, first aid center, hospital etc. Alternate sources of power supply for operating fire pumps, communication with local bodies, fire brigade etc., will also be clearly identified. Adequate number of external and internal telephone connections will be installed.

7.2.4.7 Fire Protection System

The fire protection system for the proposed mine will consist of,

- a. Portable water supply arrangement.
- b. Portable hand appliances of suitable types / capacities for extinguishing small fires in selected areas of the mine / storage areas.

7.2.5 Safety Plan

Safety of both men and materials during mining of operation phases is of concern. Safety plan will be prepared and implemented in the proposed site. The preparedness of an industry for the occurrence of possible disasters is known as emergency plan. The disaster is possible due to collapse of rock structures and fire/explosion etc. Keeping in view the safety requirement during mining a safety policy will be formulated with the following regulations:-

- To allocate sufficient resources to maintain safe and healthy conditions of work;
- To take steps to ensure that all known safety factors are taken into account in the operation and maintenance of men, machinery and equipment;
- To ensure that adequate safety instructions are given to all employees;
- To provide wherever necessary protective equipment, safety appliances and clothing and to ensure their proper use;
- To inform employees about materials, equipment or processes used in their work which are known to be potentially hazardous to health or safety;
- To keep all operations and methods of work under regular review for making necessary changes from the point of view of safety in the light of experience and upto date knowledge;
- To provide appropriate facilities for first aid and prompt treatment of injuries and illness at work;
- To provide appropriate instruction, training, retraining and supervision to employees in



health and safety, first aid and to ensure that adequate publicity is given to these matters;

- To ensure proper implementation of fire prevention methods and an appropriate fire fighting service together with training facilities for personnel involved in this service;
- To organize collection, analysis and presentation of data on accident, sickness and incident involving people injury or injury to health with a view to taking corrective, remedial and preventive action;
- To promote through the established machinery, joint consultation in health and safety matters to ensure effective participation by all employees;
- To publish / notify regulations, instructions and notices in the common language of employees;
- To prepare separate safety rules for each type of occupation / processes involved in at site; and
- To ensure regular safety inspection by a competent person at suitable intervals of all buildings, equipments, work places and operations.

7.2.5.1 Safety Organization

Conceptual / Planning Phase

A qualified and experienced safety cum environment officer shall be appointed. The responsibilities of the safety officer include identification of the hazardous conditions and unsafe acts of workers and advice on corrective actions, conduct safety audit, organize training programs and provide professional expert advice on various issues related to occupational safety and health. He is also responsible to ensure compliance of Safety Rules / Statutory Provisions.

7.2.5.2 Safety Circle

In order to fully develop the capabilities of the employees in identification of hazardous processes and improving safety and health, safety circles would be constituted in each area of work. The circle would consist of 3-5 employees from that area. The circle normally will meet for about an hour every week.

7.2.5.3 Safety Training

A full-fledged training center will be set up at the plant. Safety training will be provided by the Safety Officers with the assistance of faculty members called from Professional Safety



Institutions and Universities. In addition to regular employees, limited contractor labors will also be provided safety training. To create safety awareness safety films will be shown to workers and leaflets will be distributed. Some precautions and remedial measures proposed to be adopted to prevent fires are:-

- Spread of fire in horizontal direction would be checked by providing fire stops;
- Reliable and dependable type of fire detection system with proper zoning and interlocks for alarms are effective protection methods;
- Housekeeping of high standard helps in eliminating the causes of fire and regular fire watching system strengthens fire prevention and fire fighting; and
- Proper fire watching by all concerned would be ensured.

Safety Management System (SMS)

A guidelines for implementing and ensuring safety in mine with the help of safety management system. This can be implemented in the proposed mine lease area for effectiveness and reducing Hazards.

Mining can be split in to in three levels

1. Strategic Level
2. Management Level
3. Operational Level

1. Strategic Level

- a. Development of organization mission statement and policy, giving high regard to safety and production, strongly backed by management and owners.
- b. Policies by the organization to ensure health and safety in all mining activities.
- c. Delegation of organizational responsibility
- d. Discussion of safety structure
- e. Establishment and maintenance of Safety Management System.

2. Management Level

- a) Implementation and management of site-specific Safety Management Plans.
- b) Identification of major hazards and assessment of risks
- c) Managing hazard reduction plans.
- d) Defining appropriate roles and responsibilities
- e) Having personnel with appropriate competencies for the work



- f) Having site-specific emergency processes in place and tested.
- g) Providing appropriate guidelines, directives and training.
- h) Operation of formal structures and committees.

3. Operational Level

- a) Includes Managers/ Safety officers, workmen inspectors and workers
- b) Assess risks associated with each step of all work
- c) Develop and maintain a Manual outlining work safe standards and guidelines
- d) Ensure personnel are trained to a competent level for each work task
- e) Follow safe operational processes and procedures.
- f) Actively participate in safety committees and continuous improvement

7.3 Social Impact Assessment

The proposed mining activities will have negative and positive impacts in the Socio-Economic environment. Chapter-4 of this report deals with the impacts associated with the socio-economic environment.

7.4 Réhabilitation & Re-settlement (R & R) Action Plan

The land for the proposed quarry is private land and is predominantly rubber plantation and without any human habitation. Therefore there is no displacement of people from the core zone of the project, hence Rehabilitation & Resettlement (R & R) is not applicable to the instant project. The nearest habitation is located at about 270 meters (NW direction) (near BP1).

7.5 Corporate Environment Responsibility (CER)

In order to find out the need of the area for the delivery of activities under Corporate Environment Responsibility, a need assessment study was carried out. The community need assessment study was carried out by Socio – Economic Expert, accredited by QCI/NABET in Kumaranellor Village, Karassery Grama Panchayat, Kozhikode Taluk & District, Kerala. The main purpose of the study is to assist the project proponent in delivering the Corporate Environment Responsibility which is part of Environment Management Plan. The EMP/CER is made to comply with the OM No.22-65/2017-IA.III dated 30-09-2020 and OM No.22-65/2017-IA.III dated 20-10-2020 Issued by Ministry of Environment Forest & Climate Change.

Community Need Assessment conducted to gather accurate information to identify the needs of community. Need assessment study is carried out prior to taking action and are used to



identify issues for action, establishing the essential foundation for vital planning. The process is an invaluable tool for involving the public in solving problems and for achieving development.

7.5.1 Methodology of study

To conduct the study, primary and secondary data were used.

Primary Data: Stake holder consultation, unstructured interview, transect walk and telephonic survey.

Secondary data: Yearly Project Document (*Padhadhirekha*) of the Panchayat, Census Report-2011.

7.5.2 Stake holders Consulted

To identify the community needs, conducted consultation with stakeholders. The details of stake holders are given below.

Table 7.2 : Stake holder consulted

S.N.	Name of Stakeholder	Designation	Mob. No.
1.	Ms. V P Smitha	President, Grama Panchayath, Karassery	7559094221
2.	Mr. Jamshid Olakara	Vice President, Grama Panchayath, Karassery	9846798373
3	Ms. Renuka Kolleri	Officer, Krishi Bhavan	9072392447
4.	Mr. Arun Lal	Health Inspector, Family Health Centre, Karassery	8281937551
5.	Ms. Sajini K	Officer, Khadhi Production Centre Maranjatty	9048635082
6	Ms. Leela KP	Anganwadi Worker, Chundathpoyil	8547573976
7.	Ms. Reji Francis	H M, Govt. U P School, Chundathpoyil	9495589977
8.	Ms. Pushpa Rani	H M In-charge, Govt. U P School, Chundathpoyil	9605848222
9.	Mr. M T Muhammad	H M, Govt. Tribal School, Koombara	9645335382
10.	Mr. Ahammed Naseef	Teacher, Govt. Tribal School, Koombara	9633831450



7.5.3 Identified Needs of the Community

In the assessment, identified many needs at Karassery Grama Panchayat and nearby in the field of Education, Health, Environment and Infrastructure. During consultation with stakeholders many needs were emerged and the main needs of the community are listed below:-

1. Construction of new buildings for FHC, Karassery
2. Protection wall for streams
3. Road construction
4. Construction of houses for Economically backward families
5. Construction of protection wall for Govt. Tribal School, Koombara
6. Construction of Computer lab and Auditorium for Govt. Tribal School, Koombara.
7. Construction of Rest room and Dining room for Khadhi Production Center
8. Solar Fencing for agriculture fields

7.5.4 Selected activity to be done under CER

Even though there are many needs/demands in the community to be fulfilled, the project proponent has selected construction of new building for Family Health Centre considering the importance & impact in the community and fund which can be generated through Quarrying industry.

7.5.5 Construction of new buildings for Family Health Centre (FHC), Karassery

What is FHC

The Government of Kerala has decided to strengthen the health care system through "*Aardram Mission*". Transforming Primary Health Centres into Family Health Centres (FHCs) by redefining the package of services offered and also improving their quality is one of the prime strategies of the Mission. The transformed services aim to achieve universality (making services available to all irrespective of whether they approach institutions or not) and comprehensiveness (includes promotive, preventive, curative, rehabilitative and palliative services). The services should be appropriate, rational and of good quality, responsive to the needs of the client group, addressing social determinants of health through intersectoral collaboration and community participation. The services should address equity considerations across gender and different segments of population that require special care.

The service provision through FHC will be institution based, field or outreach based as the case may be. Curative, counseling, health education, immunization, medico-legal, pharmacy and



laboratory are some of the institution based services. Field based services include outreach activities carried out for various public health programs and routine services by JPHN, JHI, ASHA and AWW.

FHC in Karassery Grama Panchayat

As part of Government programme, the Primary Health Centre was upgraded to Family Health Centre. The FHC is located in Kumaranallur. There are 2 old buildings in the compound where FHC and sub centre is working one small building is under construction for subcentre. About 200 patients are coming to the FHC in a day for their treatment and other services.

Main Activities of FHC





Treatment should be provided to all patients attending the OPD of FHC adhering to the Comprehensive Primary Health Care (CPHC) treatment guidelines, Essential lab services on all six days (Monday to Saturday): 8 am to 4 pm (If only one lab technician is available.), Medicines as per the CPHC treatment guidelines should be dispensed from FHC, Counseling, Health education and guidance services, Counseling, Health education and guidance services screening for persons with disability through Anganwadi centres and camps, Referral of cases to DEIC at the earliest, Follow up of people living with disability in the community, Provide medical & other supportive care at domiciliary level like wheel chairs, crutches etc., Provide home care for bedridden patients and other patients requiring palliative care, Provide pain relief for patients with terminal illness using oral morphine or other analgesics as and when required Issue of certificates

New Building for FHC – Justification

- FHC is working in old building
- Lack of adequate space in the existing building
- Lack of Fund with Local Self Government to enhance infrastructure facility



The geo-tagged photograph of the existing FHC is provided at Plat 7.1.

Plat 7.1 : Photographs of Existing FHC	
	
Photo-1 (existing FHC)	Photo-2 (existing FHC)
	
Photo-3 (existing FHC)	Photo-4 (existing FHC)

7.5.6 Proposal for Construction of buildings for FHC

The project proponent is intending to construct new buildings with 4,000 sq.ft. to enhance the facilities of Outpatient Department, Laboratory and Pharmacy. The main facilities in the proposed building with built-up area of 4,000 sq. ft. to be provided is mentioned below:-

1. Rooms for Doctors
2. Waiting area for patients
3. Observation room
4. Pharmacy and storeroom
5. Laboratory



6. Toilet and urinal

7. Office

The FHC is having about 50 cents of land for the development of new building near to the existing building. The geo-tagged photograph of the proposed land for the construction of new building is given at Plate 7.2



7.5.7 Detailed Specifications of CER activities with budget

Detailed Specifications of CER activities with budget are given below :-

Name of Activities	Specification	Cost (in Rs.)
Construction of building	Rs.1,500 x 4,000 sq.ft	60,00,000
Furniture	Lumpsum	5,00,000
Total		65,00,000

7.5.8 Working plan for CER activities

The project proponent will execute the proposed activities within first 2 year after obtaining Environmental Clearance. The work plan is detail below in the table.

Name of Activities	Working Plan	Cost (in Rs.)
Preparatory works like design of building, getting approvals etc.	1 st year	5,00,000
Construction of building and other facilities	2 nd year	60,00,000
Total		65,00,000



7.5.9 Source of Fund

To make the project a reality, the funds to be spent will be generated from the CER of project proponent. The details of the company with their project cost and proposed amount to be spent under CER is provided below in the table.

Name of the Project	Project Cost, (Rs. in crores)	2% of Project Cost, (Rs. in lakh)	Allotted found for CRE (Rs. in lakh)
M/s Mukkom Property Developers Pvt. Ltd.	12.197	24,39,400	65,00,000 5.62% of project cost

7.5.10 Fund Management

A Joint account will be open in a scheduled bank to keep the fund. All expenditure will be routed through this account for transparency and accounting purpose. The monitoring committee can decide who should be the members in joint account.

7.5.11 Sustainability of the project

The running of FHC is the responsibility of joint responsibility of Centre, state and Local Self Government. The salary of staff is being provided by the state Government and the Hospital Management Committee. The building maintenance is the responsibility of Local Self Government.

7.5.12 Monitoring Committee

A monitoring committee will be constituted for the internal monitoring of purchase of materials and construction of FHC. The monitoring committee will be consist of One representative from Grama Panchayat, FHC District Collector or his/her representative, representative from District Medical Office, two representative from Project proponent. The monitoring committee can invite experts in relevant field to this committee for proper implementation of the project.

7.5.13 Impact of the Project

The major impacts due to this project is listed below :-

- Satisfied patients and public
- Quality treatment and service
- This can maintain the quality of medicines



CHAPTER – 8

PROJECT BENEFITS

8.0 PROJECT BENEFITS

Introduction

The land for the proposed building stone quarry is private land. The proposed mining activity involves a capital expenditure of Rs. 12.197 Crores for the mining project.

8.1 Improvements in the Physical Infrastructure

The project proponent will spend minimum amount of about Rs. 65,00,000/- as Corporate Environment Responsibility (CER) in social / infrastructure facility within the surrounding area which will result in the improvement of physical infrastructure in the surroundings.

1. Construction of buildings for FHC, Kumaranallur

8.2 Improvements in the Social Infrastructure

The improvements in the physical infrastructure of the area are in the field of medical facilities. Such facilities are being provided in the form of first aid centre at mine site and these medical facilities would also be available for the local people as well in case of emergencies. Further, the project proponent supports the recreation activities of the youth around the vicinity of the project by providing the maintenance of health club and indoor tennis court.

8.3 Employment Potential – Skilled; semi-skilled and un-skilled

The proposed mining activities will provide employment to local persons of different skills and trades on contractual basis. The local population will be given preference for employment to the tune of about 50 persons direct employment and about 150 persons indirect employment. The employment potential will ameliorate economic conditions of these families directly and provide employment to many other families indirectly, who are involved in the business and service related activities.

Employment of local people in primary and secondary sectors of project will upgrade the prosperity of the region, which will in-turn improve the socio-economic conditions of the area. The employers will contribute to the provident fund, ESI and provide facilities as per the relevant labour laws.

8.4 Other tangible benefits:

Tax benefits to the Government

The proposed capital expenditure of the proposed mining activities is Rs. 12.197 Crores. The provision of employment also directly contributes to additional income tax and also indirectly



contributes to additional GST due to various transactions. The operation of the project also results in additional GST and State by way of royalty, taxes and duties. The annual income to the Government by way of taxes and duties will be of about Rs. 144 Lakhs (Rs. 48/- x 3,00,000 Tons) from the proposed quarry operation. The employment opportunity and the revenue to the government will have the following impacts:-

- This would lead to increase in purchasing power of local habitants and as a result of which, Increased revenue generation for the Local Self Government, State Government and Central Government by way of royalty, taxes and duties;
- There will be significant change in the socio-economic scenario of the area.
- Overall, this mining project will change living standards of the people and improve the socio-economic conditions of the area.



CHAPTER – 9

**ENVIRONMENTAL COST BENEFIT
ANALYSIS**

9.0 ENVIRONMENTAL COST BENEFIT ANALYSIS

Appendix-III of EIA Notification, 2006 (Generic Structure of Environmental Impact Assessment Document), states that "Environmental Cost Benefit Analysis" is to be elaborated in the EIA report provided such a study is mandated by the Expert Appraisal Committee (EAC) / State Expert Appraisal Committee (SEAC) at the scoping stage of the proposal. In the instant project, since the SEAC, Kerala has not prescribed for such a study during the scoping stage and hence not part of the approved "ToR" and therefore, there is no description of "*Environmental Cost Benefit Analysis*".



CHAPTER – 10

ENVIRONMENTAL MANAGEMENT PLAN

10.0 ENVIRONMENTAL MANAGEMENT PLAN

Introduction

This chapter deals with the description of administrative aspects of ensuring the mitigative measures proposed for the significant impacts identified in Chapter 4 due to the mining activities on each facet of environment viz. Land Environment, Water Environment, Noise Environment & Vibration, Ecological Environment, Socio-economic Environment and Air Environment.

10.1 Description of the administrative aspects of ensuring mitigative measures are implemented and their effectiveness monitored, after approval of EIA.

The lessee (project proponent) will adopt Environmental Management System (EMS) which will assist the management to meet both current and future environmental requirements and challenges.

The following components are being taken to establish an EMS; Organizational Commitment, Environmental Policy, Environmental Impact Assessment, Objectives and Targets, Environmental Management Plan (EMP), Documentation, Responsibilities and Reporting Structure, Training, Environmental Review Audits and Emission and performance monitoring.

The mine management will follow a comprehensive and systematic health and safety function which involves all personnel seeking to identify hazards and assessing risk to prevent and eliminate all accidents/injuries. The management will prepare a detailed eco-restoration and mine closure plan of mine operation prior to the commencement of the mine operation.

Objectives of EMS:

- Implement and maintain an integrated EHSQ management system to achieve sustainable performance.
- Adopt and sustain a Business Excellence framework for continual business process improvement.
- Protect Environment, conserve natural resources, reduce energy consumption, improve occupational health and safety performance and mitigate risks by adopting optimal production processes and services, driven by environment friendly technologies.
- Comply and endeavor to exceed all applicable legal and other requirements.



- Continuously strive to achieve satisfaction of all stakeholders through contribution to social development.
- Communicate effectively about the EHSQ system and create awareness and increase the competency of all employees through training.
- Establish specific organizational structure for guidance, implementation and regular review of EHSQ management system.

Environmental policy

The Environmental policy approved by the Project Proponent, viz. M/s Mukkom Property Developers Pvt. Ltd. has a well laid down Environment Policy and which is as follows:-

- Integrate the consideration of environmental concerns and impacts into all the decision making & activities.
- Promote environmental awareness among the employees and encourage them to work in an environmentally responsible manner.
- Train, educate and inform our employees about environmental issues that may affect their work.
- Wherever required by legislation or where significant health, safety or environmental hazards exist, develop and maintain appropriate emergency and spill response program.

The policy cited above is : appropriate to the organization business, shows commitment for continual improvement, a framework for setting objectives and a review mechanism, communicated and understood all within the organization and it is focused on customer satisfaction.

Responsibility

The Environmental Officer of the lessee will be responsible for maintaining ecological balance by adequate environmental protection and environment improvement works. In the event of observation of non compliance by any employee, the same is informed by the Environmental Officer to the Mine Manager and to the lessee. These three will identify the cause and implement the mitigation measures or engineering controls or work practices required. The Environmental Officer will monitor the environmental performance and guide the Mines manager and the employees for maintaining good environmental practices and to adopt newer, safe and cleaner technologies.



Environment Management Cell (EMC)

A Cell for Environment Management within the mine, will take overall responsibility for co-ordination of the actions required for environmental management and mitigation, and to monitor progress of the mitigative measures and actions to be taken by the lessee. The Cell will be under the overall supervision of the Environmental Officer, and will be responsible for monitoring of the implementation of the various measures as mentioned in Chapter 4. The Environmental Cell will report on a regular basis to the lessee. The meeting of the Environmental Cell is to be held on every month on regular basis. The minutes of meeting of Environmental Cell is to be documented. The report containing recommendations of Environmental Cell is to be submitted to the management within a week from the date of meeting of Environmental Cell.

The Environmental Management Cell is responsible for overseeing; supervision, during collection of water, ambient air, ambient noise, soil samples within and outside the core zone by NABL accredited laboratory; implementation of the pollution control and protective measures; eco-restoration and green area development; co-ordination of the environment related activities; collection of the statistics of health of workers; implementing safety programs; and monitoring progress of implementation of EMP.

The lessee will constitute the Environment Cell for the proposed quarry and the structure of the Environmental Cell is given at Table 10.1.

Table 10.1 - Details of Environmental Management Cell

SN	Members	Role
1.	Lessee (Managing Director of M/s Mukkom Property Developers Pvt. Ltd.)	Chairman
2.	Mines Manager	Member
3.	Safety and Health Officer	Member
4.	Representative of NABL accredited laboratory	Member
5.	Representative of NABET accredited Consultancy Organization	Member
6.	Representative of the stakeholder / social worker in the vicinity of mine lease area	Member
7.	Environmental Officer	Convener
Frequency of Meeting – Once In a month		



A format of affidavit to be submitted to SEIAA, Kerala regarding the constitution of Environment Management Cell (EMC) is prepared and is attached at **Annexure No. 10.1.**

Summary of the responsibilities of EMC :-

- Implementation and maintenance of all facilities proposed in EMP
- Supervision of compliance to the conditions of EC & conditions in other statutory approvals.
- Log book regarding cleaning of garland drain, silt traps & pond.
- Implementation of CER activities
- Green area development in buffer area & compensatory afforestation area.
- Log book for water level of observatory well (pre-monsoon, during monsoon & post monsoon)
- Log book of accidents and occupational health related matters.

Other Management Aspects of the Environmental Cell.

As explain in the Chapter 2, all statutory approvals will be obtained for the proposed quarry. Records will be maintained of the analysis reports of ambient air quality, ambient noise levels, water quality and soil quality to observe variations (if any). These records are not only required for the perusal of the statutory authorities but for the management also. The records as per the Hazardous waste regulations, 2016 and EPA regulations, 1986 are to be maintained. Obtaining the Authorization for the intermediate storage of hazardous waste as per the Hazardous Waste (Handling & Management) Rules and its renewal. The mine shall obtain the Consent for Establish (CFE) and Consent to Operate (CTO) as required under Section 25/26 of the Water Act, 1974 and under Section 21/22 of Air Act, 1981, before the commencement of production and commissioning from Kerala State Pollution Control Board (KSPCB). The CTO will be renewed as per the KSPCB guidelines by the management. The mine will submit Environmental Statement every year before September 30. The management ensures that it will comply with all the directions and regulations issued by the Ministry of Environment, Forests & Climate Change (MoEF&CC), New Delhi, State and Centre Pollution Control Board. The "Consent to Operate", mine lease and Explosive license and all other statutory approvals will be displayed in a prominent location in the office of the mine for the information of the inspecting authorities of different departments and all stake holders.



After obtaining Environmental Clearance (EC), the six monthly compliance report as per EC conditions will be submitted regularly by the project proponent to the Regional Office of MoEF&CC at Bangalore and State Environment Impact Assessment Authority, Kerala and would be uploaded in the website of the lessee.

Standard Operating Procedures (S.O.P.)

The Environment Management Cell will develop standard operating procedures for the following :-

- Compliance to the conditions of Environment Clearance (EC) and the submission of six monthly compliance report of the E.C. conditions.
- Compliance to the conditions of "Consent to Operate" (CTO).
- Compliance to the conditions of all statutory approvals.
- Renewal of approvals before the expiry of the approvals.
- Implementation of the Corporate Environment Responsibility (CER) activities.
- Compliance to the conditions of quarry approval and other regulations updated time to time by Mining & Geology and under KMMCR, 2015.
- The lessee proposed to engage services of the faculty of Botany of the nearest Government college for the ecological reporting of the site once in three years. This study includes the growth rate of floral species planted at site, survival rate, etc.

Description of Precautions to be taken after obtaining EC

Following precautions are taken after the issuance of the Environmental Clearance:

- Strictly following the conditions mentioned in Environmental Clearance by the project proponent and the same will be assured from the relevant authorities.
- The relevant authorities have the power to revoke the Environmental permit if the implementation and maintenance of these Terms are violated at any time.
- Once the Environmental Clearance is obtained, the terms and conditions will be displayed on the board at the entrance to the quarry site. The website address should also be displayed on this board.
- Every six months, the applicant should submit a report on the compliance of the Environmental Clearance conditions to the Regional Office of the Union Ministry of



Environment and Forests, Bangalore and to the State Environmental Impact Assessment Authority, Kerala.

- In addition, the above report should be published on the applicant's website. By viewing this website, the public can become aware of the compliance with the above terms and conditions.
- The Environmental Clearance will be revoked if it is found that there has been any breach of EC Conditions.

10.2 Cost Estimate for Environment Management Systems

The mitigation measures on the environment safeguards and measures for successful monitoring and implementation of pollution control measures as well as the eco-restoration and green area development is provided in Chapter-4. The capital cost for implementation of schemes under Environment Management Plan is about **Rs. 164 Lakhs** and annual recurring cost is about **Rs. 51 Lakhs**.

Table 10.2 Budgetary Allocation of Environment Management Plan (all the expenses involved for implementation for mitigation plan during pre-mining, mining & post mining)

Description	Item	Capital Cost	Recurring Cost	Remarks
		(Rs. In Lakhs)		
LAND ENVIRONMENT	Construction of retaining wall for waste dump in lower contour	4.1	2.8	Cost of construction of wall around the dip side of the dump.
	Slope stability measures including :- a) Installation of a proper bund (portable) b) Daily monitoring of height & width of benches through survey	3.0	-	-
	Breaking of loose boulders	2.0	-	Breaking of loose boulders in core, buffer & immediate surrounding.
	Construction of appropriate haulage road	5.0	-	
	Sub-Total	14.1	2.8	
WATER ENVIRONMENT	Construction of garland drains with intermittent siltation traps (storm water management)	12.0	5.6	Once only for the lease period /life of mine.



	De-silting operations	7.0	2.8	Yearly and manual operation
	Construction of pond (rain water harvesting) & fencing around the pond	7.0	1.0	-
	Outside the project area overland flow management to prevent ingress to the ML area.	4.0	3.0	-
	Stone pitching in seasonal drain & providing stone barriers within drain to reduce velocity of flow.	2.0	-	
	Construction of septic tank	0.5	0.1	
	Sub-Total	32.5	12.5	
NOISE & VIBRATION ENVIRONMENT	Maintenance of machinery suitably	4.4	4.2	Included in maintenance cost
	Rubber lining of floor of tippers	0.5	-	
	Blast mats	1.0	0.5	As and when needed (L/S)
	PPE's like Ear muffs	2.0	1.2	Once in six months
	Acoustic enclosure for DG set & compressor	3.0	0.5	-
	Blasting siren / hooters and notice boards / signages	2.0	0.2	-
	NONEL blasting technique	4.0	-	-
	Sub-Total	16.9	6.6	
ECOLOGICAL ENVIRONMENT	<ul style="list-style-type: none"> • Green Area development in buffer of ML area. • Development of medicinal garden own land outside mine lease area owned by PP. • Development of Butterfly garden. • Development of vegetation around the drain and around the storm water collection pond to increase the moisture content in soil. 	42.90	4.3	-



	<ul style="list-style-type: none"> • Clearing and burning of alien invasive species in ML area and surroundings 			
	<ul style="list-style-type: none"> • Eco-restoration of the area owned by PP abutting the Forest area in east & south direction including fodder cultivation. 			
	<ul style="list-style-type: none"> • Construction of water holes in the area owned by PP abutting the forest area in east and south direction. 			
	<ul style="list-style-type: none"> • Installation of hanging solar fencing in consultation with Forest department. 			
	<ul style="list-style-type: none"> • Providing funds to Forest Department for cutting and burning of alien invasive species in forest land. 			
	<ul style="list-style-type: none"> • Providing funds to Forest Department for preventing forest fire. 			
	Sub-Total	42.90	4.3	
SOCIO-ECONOMIC ENVIRONMENT	Corporate Environment Responsibility (CER)	65.00	-	Compliance of the MoEF&CC guidelines.
	Sub-Total	65.00	-	
OCCUPATIONAL SAFETY AND HEALTH	First aid kits – 2 nos. Fire extinguishers-2 nos.	2.5	1	Once in year, replace by conducting periodically check-up
	Training and awareness programs on risk factors during emergencies by the	2.5	3	Once in six months and create sign boards about the risk



	experts.			and safety precaution regularly.
	Periodical medical check-up and supply of medicines	4.5	4	Once in a year and supply of medicines for every three months.
	Sub-Total	9.5	8.0	
AIR ENVIRONMENT	Personnel Protective Equipments (PPE) to mine workers	7.0	1.5	Safety shoe twice in a year, helmets once in three years and hand gloves (daily), ear plugs, safety goggles
	Uniform for mine workers	0.5	0.3	Issued six monthly
	Wetting of roads (paved and unpaved) mobile and stationery sprinkler system	11.2	7.0	Water tanker cost @one tanker per day for 300 days.
	Development of green belt :- a. On road side-3m interval and buffer zone – 3m interval plus maintenance	7.0	1.4	Re-plant the non-surviving plants, watering and protection from animals.
	Regular cleaning of paved roads,	0.15	4.2	Two workers daily
	Construction of speed controllers	0.7	0.15	Construction cost of speed breakers
	Asphalting of roads and its maintenance	21.0	2.1	-
	Sub-Total	47.55	16.65	
	GRAND TOTAL	163.45 Say 164	50.85 Say 51	



CHAPTER – 11

SUMMARY AND CONCLUSION

11.0 SUMMARY AND CONCLUSION

11.1 Overall Justification for implementation of the project

11.1.1 Supply and demand of building stone

From the study it is observed that, only in the building construction sector alone, the consumption of building materials (sand & aggregates) in the vicinity of the project for the last few years is much more than the materials already available locally. Further, there is pattern of annual increment of about 10 to 20%. Taking into consideration other activities like road construction, road maintenance etc., and the increase in demand in every year (@10 to 20%), there is a heavy shortage of coarse aggregates, fine aggregates and M-sand in the study area and therefore the need of the project is justified. The production of the proposed quarry would be 3,00,000 per annum.

11.1.2 Habitation

The nearest habitation is at a distance of 270 meters (in NW direction of near BP 1) away from the proposed mine sites. As per the requirement set by State Environment Impact Assessment Authority (SEIAA), Kerala, the distance to the nearest habitation should be at a distance of 50 meters. Therefore, the instant proposal meets the above requirements and is justified.

11.1.3 Ecological Sensitivity

There is no Ecological Sensitive Area (ESA) / Ecological Sensitive Zone (ESZ) located within 10 kms from the periphery of ML area. There is Forest Area is located about 101 m. from the ML area and no forest land is located within the ML area. Therefore, the mine lease area is justified w.r.t. the location of ecological sensitive areas.

11.1.4 Landslide

As per the Landslide Zonation Map prepared by State Disaster Management Authority (SDMA) of Kerala, it can be inferred that the about 90% of the ML area is falling within Medium Hazard Zone area (Moderate Zone) and remaining area is safe zone. The nearest High Hazard Zone is 4.4 km (NE direction) from the proposed ML area. Further, all the regulations prescribed by SDMA / CPCB / SEIAA will be followed during mining activities at site and therefore, the mine lease area is justified.

11.1.5 Flood

The flood zonation map published by State Disaster Management Authority, Kerala is referred. From the map it can be inferred that the core zone and is not in the flood prone area. The



nearest flood prone area is located at 1.3 km in NE direction from the boundary of project site and therefore, the ML area is justified.

11.1.6 Slope

The highest slope of the ML area is 25° and lowest is 6°. The average angle of slope of the mine lease area is about 16° therefore, the site is justified.

11.1.7 Top soil & Overburden

The mine lease area (core zone) is with stripping ratio (1:0.040245) much below the permissible level of 1 and therefore, the site is justified.

11.1.8 Vegetation

The vegetation in the mine lease area is mixed plantation and devoid of RET species and therefore, the site is justified.

11.1.9 Proximity to Kozhikode District

The mine lease area is within the Karassery Grama Panchayat in Kozhikode District where various types of infrastructure projects are in different stages of implementation and in the planning stage. In order to support these activities, building stone is required.

11.1.10 Mineral Reserve

The mine lease area (core zone) have large deposit of mineable building stone and the selection of mine lease area is justified.

11.2 Explanation of how, adverse effects have been mitigated.

11.2.1 Mitigation measures on Land Environment:

Pre-mining operations – Mitigation measures

- Prevent inadvertent entry by persons or animals in buffer zone for which barbed fencing of about 4 feet height will be provided.
- Identification of suitable location for storage of top soil / overburden dump outside the ML area at the lower contour and construction of a retaining wall with weep holes.
- Construction of haulage road as per slope of the ML area.

During the mining operations – Mitigation measures

- The topsoil excavated from the quarry will be dumped / stacked separately at pre-determined place at lower contour of mine with retaining wall and weep holes will be provided and subsequently this will be utilized in spreading over reclaimed areas for plantation as part of eco-restoration so as to prevent the dump material is carried away



through overland flow and gets deposited in the surface water bodies / river ecosystem and result in swelling of ecosystem.

- The overburden (OB) will be generated throughout the mine life. This waste will be utilized within the pit and for laying of haul roads. At the end use, OB can be reutilized as soil base for plantation.
- No mining activity would be carried out in steeper slope (slope more than 45⁰).
- Mining activity in moderate slope (around 25⁰) will be carried out with appropriate slope stability and protection measures.
- As per the Landslide Zonation Map prepared by State Disaster Management Authority (SDMA) of Kerala, it can be inferred that the about 90% of the ML area is falling within Medium Hazard Zone area (Moderate Zone) and remaining area is safe zone. The nearest High Hazard Zone is 4.4 km (NE direction) from the proposed ML area. The NOC from the District Disaster Management Authority will be taken by the PP before commencement of the mining and the conditions imposed will be complied meticulously.
- Break the loose boulders in situ without blasting before commencement of regular mining located in the core area & near to buffer-7.5 meters.
- The poor quality of soil will improve w.r.t. pH and other nutrients by multi crop plantation in the eco-restoration phase added with addition of nutrients as supplement.
- Conservation of top soil for future eco-restoration work. The dump shall be provided at the lower contour with retaining walls with weep holes and with a garland drain around the dump.
- A safety zone of 7.5 m (buffer zone) would be maintained.

Post mining phase land use – Mitigation measures

The land use of the proposed project with ML area of 8.1765 ha. in the mine closure phase is prepared. Out of the total area, 5.6902 ha. + 0.7986 ha. = 6.4888 ha. (79% of the total area) will be with plantation in the mine closure phase and an area of 1.5881 ha. (about 20% of the total area) will be a converted into storm water collection pond. Development of plantation and a storm water collection pond are environmental friendly activities.

11.2.2 Mitigation measures for Water Environment:

Pre-mining operation – Mitigation Measures

- Construction of garland drain with intermittent silt traps



- Construction of a large storm water collection pond (about 8 ML capacity) for the storage of rain water to be located outside the mine lease area at the lower contour.

During the mining operation – Mitigation Measures

Impact of Hydrology vs Mitigation Measures -

- There is increase of 100 ML of overland flow and to reduce its impact on the seasonal drain, a large rain water collection pond of capacity about 8 ML will work as a cushion / shock absorber so as to reduce the impact on the seasonal drain. Necessary carrying capacity study is carried out on the drain based on the peak rainfall.
- A study on ground water of 1 km surrounding of the core zone was carried out and based on which, the ultimate depth of mine is decided. It is observed that the ground water table is in the range of 42.0 MSL – 44.8 MSL. The ultimate depth of mining is fixed at 45 MSL. Hence there is no intersection of ground water table and no impact on hydrogeology.

Loss of watershed and its mitigation measures

- The strengthening of green area development in the 7.5 meters buffer zone and in the benches and in the compensatory afforestation area will increase moisture retention in soil.
- Storm water collection pond (about 8 ML capacity) will enhance the moisture retention in the surrounding soil.
- The species selected for green belt development and for compensatory afforestation will be all native which can slow the surface runoff thereby soil erosion can be reduced. The slower runoff lead to more percolation through water holding.

Assessment of the water quality of natural stream which receives the drainage from the project area.

- The water quality of the natural drain in the vicinity of the project site (upstream and downstream) will be monitored periodically (once in 3 months) to assess the quality of water.

Other mitigation measures

Overland flow

- The garland drain as per the drainage map and a reservoir (pond) in the lower contour (outside the mine lease area) will channelize and store the runoff from the mine area in the reservoir (pond).



- The runoff from the mine area is collected in the large reservoir to be constructed in the lower most contour of the area and all sediments / silt in the runoff will get settled in the reservoir. Only supernatant clear water will leave the reservoir.
- Stone barriers across the garland drains and with de-silt chambers to be constructed to check the water current and arrest the sediments.
- Stone pitching to be made at suitable locations to regulate water flow and prevent soil erosion.
- Periodical cleaning of de-siltation chambers and storm water collection pond.
- Small drains to be provided in every bench (the benches are inclined inward) which will be connected to the garland drain.
- Arrangement will be made at the edge of bench to prevent direct fall of runoff.
- The proposed quarry need to construct de-siltation traps, settling tanks / clarifiers along the drainages before storm water runoff (murky water) settling in rain water harvesting pond.
- The discharge from the vehicle work shop / runoff from the workshop area to be treated by providing oil and grease cum grit chamber.
- Measures to minimize contamination of surface and groundwater sources by disposal of sewage through septic tank.
- The water requirement for various mine related activities including dust suppression and for green area development will be met from the stored rain water in the reservoir and hence the ground water abstraction, sourcing of water from the nearby surface water and from the public supply is avoided for these activities. Therefore, there is no impact on hydrology of the area.
- Water balance of the impact zone is prepared based on the water harvesting and usage. The details of water balance of the mine is given below :-

Sr. No.	Particulars	Water Requirement (in KLD)	Source
1.	Domestic purposes (mine staff)	7	Open well
2.	Dust Suppression / Water sprinkling at mine	14	Storm water pond
3.	Green belt / Plantation	14	
	Total	35	



Post-Mining Operation – Mitigation Measures

- At the end of mining (from the proposed ML area) a storm water collection pond of about 100 ML capacity will be formed and the water stored can be utilized for irrigation purposes in the downstream during summer months.
- The PP will secure the storm water collection pond which will be formed at the end of the mining operations with appropriate fencing within the project area.

11.2.3 Mitigation measures for Noise & Vibration impacts :

Noise

Pre-Mining Operation – Mitigation Measures

- Installation of siren / hooters
- Installation of signages / boards around the mine lease area with display of blasting time.

During Mining Operations – Mitigation Measures

- The following engineering **noise control measures** to be adopted for the interruption of the noise path from the source to the receiver.
 - In order to reduce the noise levels during loading and unloading of the mined material, the tippers are provided with rubber lining in the floor of the vehicle body.
 - Selection of new low noise equipment / machineries.
 - Implementation of an effective planned preventive periodical maintenance for all equipment and machineries which is used in the mining site.
 - Blasting to be limited designated hours and the same to be notified for the awareness of people in the vicinity. The blasting should not be carried out during period when school children going & returning in the morning & evening hours.
 - The charge of explosive to be limited as far as possible so as to maintain the noise level and the vibration level as per the predicted values in the nearest habitation.
- The following administrative **noise control measures** to be adopted for the interruption of the noise path from the source to the receiver.
 - Altering the work schedule, moving the personnel further from the noise source.
 - Modifying equipment operation to eliminate or reduce sound.
 - Use of warning signs.
 - Providing personnel hearing protection devices.
- Development of green belt with native species of dense foliage which act as pollution sinks



- The nearest habitation is at about **270 meters** at NW direction of near BP1 and predicted noise levels at distances from the source is within the permissible standards.
- Quarrying operation will be carried out only during day time.

Vibration

Impact of Vibration on nearby houses and built-structures vs Mitigation Measures

- The proposed project is a new quarry project and there is no quarrying operations / blasting operations currently at site. Since the quarry operations can be commenced only after obtaining Environmental Clearance and all other statutory approvals, blasting cannot be carried out now for vibration studies. The PP approach Mining & Geology Department for permission to conduct blasting for study purposes but the Department have no provision to permit such pre-mining blasting. Therefore, the PP can not submit primary data on vibration studies to evaluate the zone of influence. Further, it may kindly be noted that there are no built-structures located within 200 meters from the periphery of the proposed mine lease area. In the above referred O.M. dt. 29-10-2014, the minimum set back distance prescribed is 50 meters only. The PP hereby commit that vibration study will be carried out through a national reputed agency within 3 months from the date of commencement of mining operations. The recommendations to be received from the agency who conducts the vibration study will be followed in letter and spirit.
- **Ground vibration** from blasting can be mitigated by the following measures :-
 - The maximum charge per delay will be about 12 kg/blast so as to limit the PPV values to 1.6899 mm/sec. at the nearest built-structure at about 270 meters (As against the permissible 15 mm/ sec.).
 - Divide total charge / blast in several parts so as to keep minimum explosive per delay i.e. use of millisecond delay detonators & relays. Or in other words controlled blasting techniques (**NONEL method**) will be adopted.
 - Careful design of blast hole drilling pattern with appropriate burden distance, spacing as holes, hole-depth, and stemming height.
 - Optimum delay sequence and stem to column ratio would be maintained to minimize the fly rock distance and ground vibration intensity.



- Avoiding blasting in unfavorable weather conditions and conduct blasting at prefixed and well advertised timings.

11.2.4 Mitigation Measures for Ecological Environment :

Pre-Mining Operation – Mitigation Measures

- Identification of suitable location outside mine lease area for compensatory afforestation (transplantation of tree saplings of endemic species) located within the mine lease area. An area of about 0.82 ha. (10% of ML area of 8.1765 ha.) outside the ML area is earmarked for compensatory afforestation and the tree plantation will be initiated before the commencement of mining operation.
- Fodder for the herbivorous animals will be cultivated outside the ML area and nearby the area abutting the forest land in south & east direction so as to restrict the animal entry in the ML area.
- Invasive alien species found in the ML area need to be cut from the root and to burn it. Burning of invasive species is necessary due to its impact on local species of crops / agriculture.
- The PP has committed to contribute fund to the Forest Department for avoid occurrence of forest fire and also for removal of alien invasive species within the forest area.
- In the area where the project site is abutting the forest, tree saplings or through other propagation measures in consultation with Forest Department, plantation of species found in the forest area will be developed. In other words, by this measure, eco-restoration of the area currently used as a plantation is ensured.
- The PP has committed to install hanging solar fencing in consultation with Forest Department in the area abutting the forest land in the east and south direction so as to restrict animals in the ML area.
- The commonly found mammals in the project site and the surroundings are Indian Porcupine, Indian Wild Boar, Bonnet Macaque, Common mongoose and which damages the crops in the vicinity and is a type of man-animal conflict. To mitigate this, native species of fruit bearing trees Banana (Vazhapazham), Greater yam (Kachil), Tapioca (Kappa), Colocasia (Chembu), Elephant Foot Yam (Chena), Sweet Potato (Madhura kizhangu) and grass species such as Tropical Carpet Grass, Indian Muraina Grass, Black spear grass, Chrysopogon asper.



etc. and also fodder exclusively for the herbivores animals will be planted in the area owned by the PP abutting the forest area.

During Mining Operation – Mitigation Measures

- Buffer area of 7.5 meters (0.8982 ha.) will be maintained all around the lease area and will be maintained as green area development (about 800 trees). In the 7.5 meter buffer area of 0.8982 ha., (total about 800 trees in each row, total two rows) and 5.6902 ha. reclamation area by plantation of 2,250 trees during conceptual stage will be planted in eco-restoration area are to be planted as part of green area development.
- The saplings of endemic species identified in the core zone to be replanted in the area outside the mine lease area marked as compensatory afforestation area to be earmarked in the land owned by the project proponent.
- Only native trees will be adopted for green area development. The trees for green area development includes fruit bearing, flowering and shady trees.
- The cutting of trees will be carried out in phases as per the developmental plan.
- Since there are various medicinal shrubs and herbs in the ML area, a medicinal garden will be developed in the area adjoining the mine lease area.
- Plantation will be carried out in the benches which is mined out earlier.
- A butterfly garden is proposed outside ML area.

Post-Mining Operation – Mitigation Measures

- Total of about 3,900 trees will be planted in eco-restoration area are to be planted as part of green area development.
- In compliance to O.M. dt. 16-01-2020 of MoEF, grassing of ML area as part of eco-restoration.
- Green belt development during eco-restoration in PMCP by plantation of the species as per the time schedule suggested below :-

First Six months	-	Herbs & grass
Next Six months	-	Shrubs
Next Six month onwards	-	Trees

11.2.5 Mitigation measures for Socio Economic environment:

Pre-Mining Operation – Mitigation Measures

- Setting up of an office, labour quarter with basic amenities.



During Mining Operation – Mitigation Measures

- The PP has set apart an amount of Rs. 65 Lakhs (about 6% of the project cost) for construction of buildings for Primary Health Care (PHC), Karassery Grama Panchayat.
- Training to locals to develop skill for employment in the mine which includes mining related machinery / equipments etc.
- Provide more employment opportunities to the people in the vicinity. A format is developed which will be notified in the Local Body, District Industries Centre (DIC), Employment Exchange.
- Access to potable water for the people in the vicinity during summer months.
- Periodical monitoring of welfare measures to be adopted for the people in project vicinity.
- Support local small scale entrepreneurs for setting up ancillary activities like supply of grocery and other allied engineering activities.
- The PP need to monitor all parameters of water used for domestic purposes of residents in the vicinity from rain water collection pond during summer season by an NABL accredited laboratory once in six months.

11.2.6 Mitigation measures on Air Environment:

11.2.6.1 Paved surfaces

- Regular cleaning of paved surfaces and wetting of the surface.
- Speed controls on vehicle movements (<30 kmph).
- Wind reduction control by way of green area development

11.2.6.2 Unpaved surfaces

- Water sprinkling on unpaved areas during dry wind periods on regular intervals through a mobile sprinkler unit of 5 KL capacity.
- Re-vegetation / eco-restoration of exposed surfaces.
- Surface improvements to be done with asphalt for stabilization.
- Speed controls on vehicle movements to limit speed.
- Wind reduction control by plantation.

11.2.6.3 Vehicles

- Vehicular emission of particulates, SO₂, NO_x, hydrocarbons can be minimized by proper training and maintenance of vehicles and other oil - operated equipments. Bi-annual emission checking (PUC) for all vehicles plying in core area shall be made mandatory.



- Speeds controls on vehicles.

11.2.6.4 Mining activity

- Since the stripping ratio is negligible (1:0.040245), there is no large quantity of handling and transportation of waste materials and therefore, no potential impact on traffic density and emissions associated with it.
- Measures to reduce the emissions of pollutants during drilling by using wet jets (Drilling by Flexi ROC T25 Drill machines),
- Using blast mats before blasting to reduce the dust emission and to reduce the fly rock movement.
- The nearest habitation is located at 270 meter at NW direction of near BP 1. Further, the pre-dominant wind direction is from North West to South East direction. In the east direction of the ML area is hilly slope, therefore, for the proposed quarry site no impact envisaged, there are large scale plantation available and therefore which will work as green barrier.
- Use of appropriate explosives for blasting and avoiding overcharging of blast holes.
- Provision of dust filters / mask / PPEs to mine workers.
- Conducting periodical medical check-up of all workers to know health problems.
- Training to personnel to create awareness
- Green cover over the top soil / overburden dump.
- Compensatory afforestation with native trees of dense foliage to be carried out in an area (outside the ML area) and which will be commenced prior to the commencement of mining.
- Development of green belt all along 7.5 m. buffer (periphery length 1,228 meters) with native species (0.8982 ha.) (about 800 nos. (about 400 trees in one row) of trees, two rows at 3 - 4 m. C/C) will be commenced prior to the commencement of mining.
- Clearing of vegetation in the core zone in phases as per development plan.
- Periodical monitoring of ambient air quality in the core zone.
- The extracted mineral will be transported from the quarry to the crusher by adopting following measures so as to minimize dust emissions.
 - The trucks after loading will be covered with tarpaulin sheets.
 - Speed of the vehicles will be maintained within the prescribed limits.



- Trucks will not be over loaded and will be maintained to body level.
 - The wetting of materials before transfer of materials.
- Modeling studies (AEROMOD-ISCST3) were carried out to assess the impacts due to the mining operations of proposed quarry and the predicted values of PM₁₀ and PM_{2.5} in the downwind direction is found. The predicted values are within the permissible ambient air quality standards.

11.2.7 Traffic management :

- A traffic study was carried out to access the current traffic on Maranchatty-Thottumukkam Road (both directions). All the products / material from the proposed quarry reaches the in the surrounding panchayaths of Kozhikode district like Karassery, Thiruvambadi, Koodaranhi, Kodyathur, Chathamangalam, Mukkom and Panchayats located in the Malappuram district which are Urangattiri, Areecode, Cheekode, Keezhuparamba, Vazhakkad etc. for supply to the end users at different locations within the Kozhikode & Malappuram District. The existing roads width located nearby the quarry are sufficient for additional traffic load from the proposed mine.
- The V/C of Maranchatty-Thottumukkam Road related to IRC guidelines is referred & it is 0.3.
- After the commencement the proposed mining activities, the traffic from the mine will be able to cater the traffic in *Maranchatty-Thottumukkam Road*.
- The rubble from the proposed mine will be sent to open market / stone crusher units located within 5 to 8 kms from the proposed mine site. The aggregates from the proposed mine will be sold to Calicut Expressway Private Limited for construction of proposed six lining of existing Kozhikkode Bypass (Vengalam junction to Ramanattukara junction) as part of infrastructure works.

11.3 Budget on implementation of Environment Management Plan

The capital cost for implementation of schemes under Environment Management Plan is about **Rs. 164 Lakhs** and annual recurring cost is about **Rs. 51 Lakhs**.



CHAPTER – 12

DISCLOSURE OF CONSULTANTS

12.0 DISCLOSURE OF CONSULTANT

12.1 The names of the consultants engaged with their brief resume and nature of Consultancy rendered.

The EIA study for the mine lease area and the preparation of EIA Report was carried out by M/s Environmental Engineers & Consultants Pvt. Ltd. (EECPL), a MoEF&CC accredited consultancy organization (ACO) under NABET/ QCI scheme. The ACO is accredited through the above mentioned scheme from 2011. The number of accreditation certificate of the ACO is NABET/EIA/2326/RA 0285 dt. 01-05-2023 valid upto 18-03-2026. The copy of the latest accreditation certificate is attached as **Annexure No. 12.1**. The ACO is accredited for Building and construction projects, townships and area development projects and open cast mining projects. The team involved in the conduction of EIA study and the preparation of the EIA report is provided below: -

Table 12.1 – Details of EIA Team

Name of consultant / expert	Role in the preparation of EIA report	Qualification & Experience in brief
P. Z. THOMAS	EIA Coordinator & *FAE for Land Use, Air Pollution, Water Pollution, Solid & Hazardous Waste.	B.Tech in Civil Engineering with specialization in industrial waste engineering. Working in the Environment field for the last 32+ years.
Jomon M C	EIA Coordinator & *FAE – Socio Economic	Masters in Social Work (MSW). Working in the Environment field for the last 11+ years.
Dr. Renoy Varghese	*FAE - Ecology & Biodiversity, Soil Conservation	Ph.D in Environmental Science. Working in the Environment field for the last 15+ years.
Mathews J. M.	*FAE – Noise & Vibration, Hydrology, Ground water and Water Conservation, Geology, Risk & Hazard Management	B.E Mining Engineering. Working in the Environment & Mining field for the last 7+ years.
Yedhukrishna. C. U. (Team Member under Mathews J.M.)	*FAE – Hydrology, Ground water and Water Conservation, Geology	Master of Science in Applied Geology. Working in the Environment field for the last 5+ years.
Mohan A. Patil	*FAE – Air Quality Modeling & Prediction	M.Tech in Energy Management. Working in the Environment field for the last 32+ years.



FAE - Functional Area Expert*12.2 Nature of consultancy rendered by Accredited Environmental Consultancy Organization (ACO)**

We, M/s ENVIRONMENTAL ENGINEERS & CONSULTANTS PVT. LTD. is a professionally managed accredited consultancy organization with Ministry of Environment, Forest and Climate Change, Govt. of India under the **National Accreditation Board for Education and Training (NABET, QCI)** scheme. The ACO is in operation for the more than last 25 years.

We assist our clients in obtaining Environmental Clearance under EIA Notification, 2006, CRZ Clearance under CRZ Notification, 2011, Wildlife Clearance under Wildlife Protection Act, 1972 from the Ministry and from SEIAAs / CZMAs across the country.

We also design, fabricate, install and commission various pollution control equipments (both liquid and air) for various industries in the country on turnkey basis. We have more than 1,000 satisfied customers in the building construction, township and mining sector for whom we have provided our services in preparation of EIA / EMP reports and technical assistance in getting Environmental Clearance and CRZ Clearance across the country. The organization provided Enviro-Legal consultancy services to various projects in different parts of the country at Hon'ble Supreme Court of India, various High Courts and at National Green Tribunal (NGT).

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Apartment No. C-306, Kanchanjunga Apartments, Civil Line Road,

Palarivattom, Kochi, Ernakulam, Kerala-682025.

E-mail :- eecochin@gmail.com

Ph. 0484-4034320.



ANNEXURES

No. 6767/M3/2019

Directorate of Mining & Geology
Kesavadasapuram, Pattam Palace .P.O,
Thiruvananthapuram - 4
Tel Fax : 0471 2447429
e-mail: director.dir.dmg@kerala.gov.in
www.dmg.kerala.gov.in
Dated : 25-07-2019

From

The Director of Mining & Geology

To

M/s. Mukkom Property Developers Private Limited,
Malayamma. P. O, N.I.T, Kozhikode District – 673 601
(Represented by its Managing Director, Shri. Abdul Azeez. C. K)

Sir,

Sub:- Mines and Minerals – Minor Mineral – Granite (Building Stone) – Application for quarrying lease under KMMC Rules 2015 – Letter of Intent - forwarding of- reg.

Ref:- 1. Your application for quarrying lease dated. 12.11.2018.
2. Letter No. DOZ/M – 3034/18 dtd. 15/07/2019 of the Geologist, District Office, Kozhikode.
3. Kerala Minor Mineral Concession Rules 2015.

Please refer to the references cited above . As per the reference 1st cited, you have applied for a quarrying lease for a period of 10 years from this office for the extraction of granite building stone from an area of **8.1765 Hectares in Unsurvey of Kumaranellor Village of Kozhikode Taluk of Kozhikode District** [as shown in the Survey Map No. A1 – 43386/2017 issued by Tahsildar, Kozhikode enclosed]. Vide reference cited 2 above, District Geologist, Kozhikode forwarded your application to this office with recommendations to issue Letter of Intent. On scrutiny of application and other documents received from the District Geologist, Kozhikode, it is seen that a quarrying lease can be granted to the precise area shown in the map under the provisions contained in the KMMC Rules 2015. However, for granting quarrying lease you have to produce following documents through District Geologist to the satisfaction of this office in accordance with the relevant statutes.

DOCUMENTS TO BE PRODUCED

1. Mining plan approved by the District Geologist as stipulated in the KMMC Rules 2015, for the precise area as per the survey map.
2. Environmental Clearance as stipulated in EIA Notification 2006 for the precise area.
3. Consent to operate quarry from the Kerala State Pollution Control Board for the precise area.
4. Explosive licence from the authorities concerned for appropriate quantity of explosives required for extraction of mineral from the precise area as mentioned in the approved mining plan.
5. Licence from the Local Self Government authorities concerned for operating quarry in the precise area.

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In addition, you shall make arrangements for the survey and demarcation by erection of boundary pillars of the said area by the revenue authority not below the rank of a Tahsildar or Asst. Director of the Department of Survey and Land Records and shall produce a certificate in this regard issued by authorities concerned.

It is also informed that the quarrying lease can only be granted subject to the final decision of the Hon'ble High Court in WP (C) No. 13031/2019 or any other decision of the Apex Court or the Government in granting quarrying lease in areas allotted for plantation.

It is further informed that the duration of lease as well as annual production of mineral will be decided based on the approved mining plan and documents submitted.

It is also informed that as per the provisions contained in the KMMC Rules 2015 this letter of intent shall be sufficient for the purpose of issuing necessary licenses/consents/Clearances/NOCs etc. by the other statutory authorities concerned. In the event of granting of quarrying lease you may also need to produce new Possession & Enjoyment Certificate at the time of grant of quarrying lease .

It is further informed that this letter of intent is valid for a period of one year from the date of issue. In case you have any valid reason for seeking extension of period of this LOI, the same may be obtained before the expiry of this LOI. Your application for Quarrying Lease shall deemed to have been rejected, if you fail to produce above mentioned documents before the expiry of LOI.

Yours faithfully



ADDITIONAL DIRECTOR OF MINING & GEOLOGY
For DIRECTOR OF MINING & GEOLOGY

Encl: Photocopy of Survey Map showing precise area

Copy to:-

1. The Member Secretary, SEIAA, Thampanoor Bus Terminal, Thiruvananthapuram.
2. The Chairman, SEIAA, Thampanoor Bus Terminal, Thiruvananthapuram..
3. The Deputy Chief Controller of Explosives, CSEZ, CGO Complex, Kakkanad, Ernakulam
4. Kerala State Pollution Control Board, District Office, Kozhikode District.
5. The Secretary, Karassery Grama Panchayath, Kozhikode District
6. The Tahsildar, Kozhikode Taluk Office, Kozhikode District.

For kind attention of statutory authorities

[The statutory authorities while issuing licence/consents/NOCs based on this letter of intent may refer this letter of intent in the respective licence/consent/ clearance /NOC while issuing the same. The statutory authorities may refer the survey map and consider the extent of applied area, quantity of mineral proposed to extract and the period of lease applied for while issuing such documents. The authorities may note that the operation as per their licence shall start only after execution and registration of quarrying lease granted by this office. All the Survey Nos./Re-Survey numbers with Block No. included in the survey map submitted in this connection shall be included in all the aforesaid documents.]

7. The Geologist, District Office, Kozhikode (The Geologist shall forward all the above said documents to this office for grant of quarrying lease with recommendations. It is informed that this LOI is issued as per the order dt. 27/05/2019 of the Hon'ble High Court in WP (C) No. 13031/2019)



2

No.DOZ/M- 3034/18

Date : 18.09.2019

CERTIFICATE

This is to certify that there is no quarry within 500 meter radius of the proposed quarry of Sri. Abdul Azeez. C.K, S/o. Ahammed, Managing Director, Mukkom Property Developers (P) Ltd., Malayamma Post, N.I.T, Kozhikode-673 601 comprised in Unsurvey of Kumaranellur Villages of Kozhikode Taluk of Kozhikode District, Kerala State.

This certificate is issued to produce before the Office of the State Environment Impact Assessment Authority (SEIAA) Kerala



(Signature)
18/9/19
District Geologist
District Office
Mining & Geology Department
Kozhikode District, Kerala

MUKKOM PROPERTY DEVELOPERS PRIVATE LIMITED

CP 2/3, CHEENATHAMKUZHIYIL HOUSE
MALAYAMMA P.O EAST MALAYAMMA, REC.VIA
KOZHICODE KERALA INDIA 673601 9745178677

RESOLUTION PASSED IN THE MEETING OF THE BOARD OF DIRECTORS OF M/SMUKKOM PROPERTY DEVELOPERS PRIVATE LIMITED HELD ON MONDAY THE 16TH DAY OF AUGUST, 2019 AT THE REGISTERED OFFICE OF THE COMPANY AT CHEENATHAMKUZHIYIL

"The Board was informed about the need of making application/s to statutory authorities including the State Environment Impact Assessment Authority, Kerala / District Environment Impact Assessment Authority, Kerala / Ministry of Environment, Forests and Climate Change seeking no objections, permission consents, etc. under the Environment Impact Assessment (EIA) Notification, 2006 with respect to its Quarrying project at UnSurvey Kumaranellor Village, Kozhikode Taluk, Kozhikode District, Kerala."

"Resolved further That Mr. C.K.Abdul Azeez Managing Director of M/s Mukkom Property developers Pvt. Ltd. be and is hereby authorized on behalf of the Company to make necessary applications / provide clarifications / documents / pay prescribed fees, etc. to statutory authorities including the State Environment Impact Assessment Authority, Kerala / District Environment Impact Assessment Authority, Kerala / Ministry of Environment, Forests and Climate Change seeking necessary no objections, permissions, consents, etc. in respect of the said project and to do all other acts, deeds and things that may be necessary in this regard."

For M/s Mukkom Property Developers Pvt. Ltd.

C.K. ABDUL AZEEZ

NOUSHAD PUTHIYEDATH VEEDU

Faizal Puthiyedath Veedu.

For MUKKOM PROPERTY DEVELOPERS PVT. LTD.
Azeez
Managing Director

Place : CHEENATHAMKUZHIYIL

Date : 16-09-2019

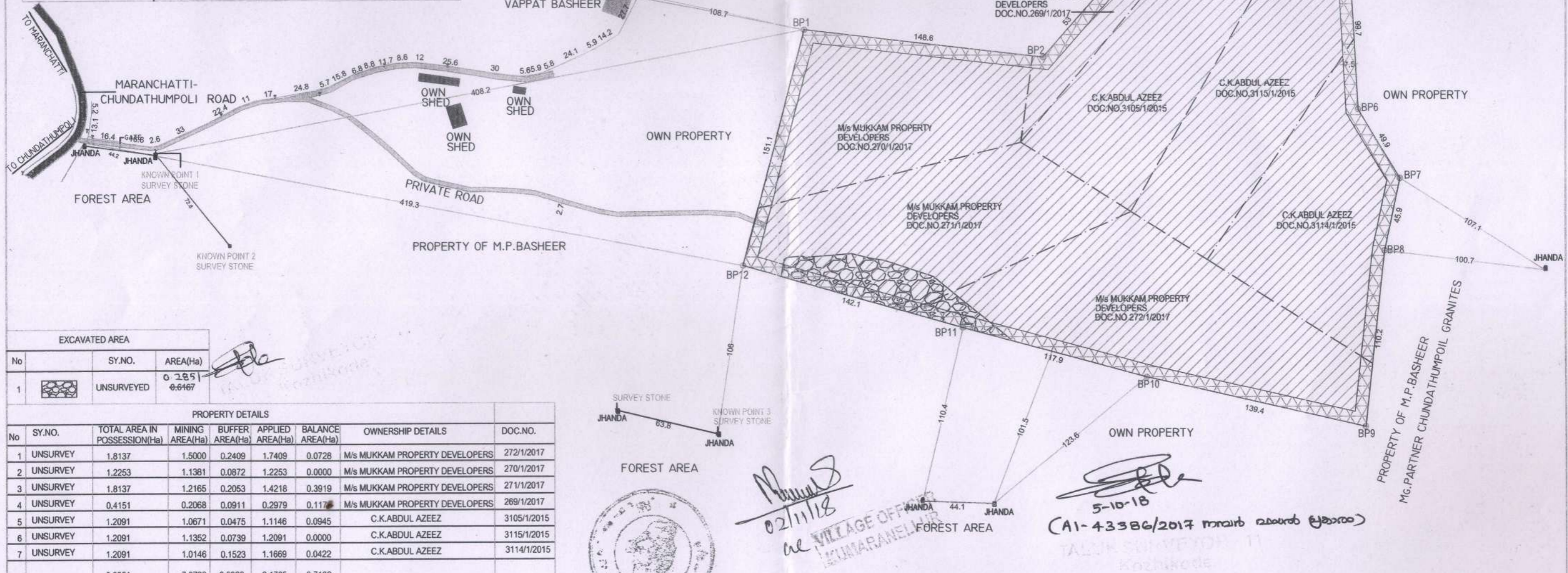
No: 940/18

SURVEY MAP C.K.ABDUL AZEEZ,MD
M/s MUKKAM PROPERTY DEVELOPERS
SURVEY NUMBER: UNSURVEYED



DESAM : ALLI

PROJECT	C.K.ABDUL AZEEZ,MD M/s MUKKAM PROPERTY DEVELOPERS
STATE	KERALA
DISTRICT	KOZHIKODE
TALUK	KOZHIKODE
VILLAGE	KUMARANELLOR
APPLIED AREA	8.1765 HECTARE



EXCAVATED AREA		
No	SY.NO.	AREA(Ha)
1	UNSURVEYED	0.2851 0.6167

PROPERTY DETAILS								
No	SY.NO.	TOTAL AREA IN POSSESSION(Ha)	MINING AREA(Ha)	BUFFER AREA(Ha)	APPLIED AREA(Ha)	BALANCE AREA(Ha)	OWNERSHIP DETAILS	DOC.NO.
1	UNSURVEY	1.8137	1.5000	0.2409	1.7409	0.0728	M/s MUKKAM PROPERTY DEVELOPERS	272/1/2017
2	UNSURVEY	1.2253	1.1381	0.0872	1.2253	0.0000	M/s MUKKAM PROPERTY DEVELOPERS	270/1/2017
3	UNSURVEY	1.8137	1.2165	0.2053	1.4218	0.3919	M/s MUKKAM PROPERTY DEVELOPERS	271/1/2017
4	UNSURVEY	0.4151	0.2068	0.0911	0.2979	0.1172	M/s MUKKAM PROPERTY DEVELOPERS	269/1/2017
5	UNSURVEY	1.2091	1.0671	0.0475	1.1146	0.0945	C.K.ABDUL AZEEZ	3105/1/2015
6	UNSURVEY	1.2091	1.1352	0.0739	1.2091	0.0000	C.K.ABDUL AZEEZ	3115/1/2015
7	UNSURVEY	1.2091	1.0146	0.1523	1.1669	0.0422	C.K.ABDUL AZEEZ	3114/1/2015
		8.8951	7.2783	0.6982	8.1765	0.7186		

Handwritten signature and date: 02/11/18

Handwritten signature and date: 5-10-18
 (A1-43386/2017 mmarb nambor (jambor))

SUBMITTED BEFORE DEPT. OF MINING & GEOLOGY



Handwritten signature: SUBRAMANIAN K.T.
 TAHASILDAR
 KOZHIKODE

LEGENDS			
	PROPOSED MINING AREA		PROPOSED MINE BOUNDARY
	BUFFER AREA(7.5M)		APPLIED AREA BOUNDARY
	JHANDA		OWN PROPERTY BOUNDARY
	EXCAVATED AREA		SURVEY STONE
	PRIVATE ROADS		PUBLIC ROADS
	OWN BUILDING		FOREST BOUNDARY LINES
	OTHER BUILDING		

Scale -1 CM= 25 M
 Date : 06-10-2017
 Project. GS 6037

No: 940/18

Demarcation Certificate

താഴെ പട്ടികയിൽ വിവരിച്ചിട്ടുള്ള 8.8951 ഹെക്ടർ ഭൂമിയിൽ ക്യാമ്പിംഗ് ലീസിനായി അപേക്ഷിക്കാൻ ഉദ്ദേശിച്ചിരിക്കുന്ന 8.1765 ഹെക്ടർ ഭൂമി പ്രത്യേകം അളന്നു വേർതിരിച്ച് ആയതിന്റെ അതിർത്തികളിൽ കോൺക്രീറ്റ് പില്ലുകൾ സ്ഥാപിച്ച് പ്രത്യേകം വേർതിരിച്ചിട്ടുണ്ടെന്ന് സാക്ഷ്യപ്പെടുത്തുന്നു.

NO	SURVEY NO	VILLAGE	THALUK	SRO	OWNERSHIP DETAILS	DOCUMENT NO	TOTAL AREA IN POSESSION (ha)
1	UNSURVEY	KUMARANELLUR	KOZHICODE	KOZHICODE	MANAGING DIRECTOR M/S MUKKAM PROPERTY DEVELEPORS PVT LTD	272/1/2017	1.8137
2	UNSURVEY	KUMARANELLUR	KOZHICODE	KOZHICODE	MANAGING DIRECTOR M/S MUKKAM PROPERTY DEVELEPORS PVT LTD	270/1/2017	1.2253
3	UNSURVEY	KUMARANELLUR	KOZHICODE	KOZHICODE	MANAGING DIRECTOR M/S MUKKAM PROPERTY DEVELEPORS PVT LTD	271/1/2017	1.8137
4	UNSURVEY	KUMARANELLUR	KOZHICODE	KOZHICODE	MANAGING DIRECTOR M/S MUKKAM PROPERTY DEVELEPORS PVT LTD	269/1/2017	0.4151
							5.2678
NO	SURVEY NO	VILLAGE	THALUK	SRO	OWNERSHIP DETAILS	DOCUMENT NO	TOTAL AREA IN POSESSION (ha)
1	UNSURVEY	KUMARANELLUR	KOZHICODE	MUKKAM	CK ABDUL AZEEZ S/O AHAMMED	3105/1/2015	1.2091
2	UNSURVEY	KUMARANELLUR	KOZHICODE	MUKKAM	CK ABDUL AZEEZ S/O AHAMMED	3115/1/2015	1.2091
3	UNSURVEY	KUMARANELLUR	KOZHICODE	MUKKAM	CK ABDUL AZEEZ S/O AHAMMED	3114/1/2015	1.2091

3.6273

ഈ സാക്ഷ്യപത്രം കരികല്ല് ഖനന ആവശ്യർത്ഥം മൈനിംഗ് & ജിയോളജി വകുപ്പിൽ ഹാജരാക്കുന്നതിനുവേണ്ടിയാണ് അനുവദിക്കുന്നത്.



M. S. S.
 02/11/18
 ae VILLAGE OFFICER
 KUMARANELLUR

വില്ലേജ് ഓഫീസർ

MINUTES OF THE 129th MEETING OF THE STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY (SEIAA) KERALA, HELD ON 26th & 27th JULY 2023 AT CONFERENCE HALL, SEIAA.

Present:

- 1. Dr. H. Nagesh Prabhu IFS (Retd), Chairman, SEIAA, Kerala**
- 2. Sri. K. Krishna Panicker, Expert Member, SEIAA**
- 3. Dr. Rathan U. Kelkar, IAS, Member Secretary, SEIAA**

The 129th meeting of the SEIAA, Kerala was held on 26th & 27th July 2023 in the Conference Hall, SEIAA, Kerala, Thiruvananthapuram in hybrid mode. The meeting started at 10.30 AM on 26th July 2023. Dr. H. Nagesh Prabhu, Chairman, SEIAA Kerala chaired the meeting. Dr. Rathan U. Kelkar IAS, Member Secretary, SEIAA and Sri. K. Krishna Panicker, Expert Member, SEIAA attended the meeting. The Authority considered the agenda for the meeting and took the following decisions:

Physical Files

Item No.129.01 **Minutes of the 128th meeting of SEIAA held on 27th & 29th June 2023**

Noted

Item No.129.02 **Application for Revalidation of EC for the Quarry Project of Sri. Biju, Managing Partner, M/s Sahara Granites at Re Survey Nos. 35/3, 35/2 part, 41 part at Erimayur-1 Village, Alathur Taluk, Palakkad, Kerala**
(File No. 146/SEIAA/KL/2747/2013)

The Authority perused the item and noted the request of the project proponent dated 20.07.2023 to give him another opportunity of hearing. The Authority decided to give one more opportunity of hearing to the project proponent in the next SEIAA meeting. The intimation regarding the hearing shall be given to the project proponent well in advance.

Item No.129.19 **Environmental Clearance for the Quarry Project at Sy. Nos 2059/1, 2060, 2061, 2063 in Kuttichira Village & Survey Nos . 928, 929, 930, 931, 932/1, 932/2 in Kodassery Village, Kodassery Panchayat, Chalakudy Taluk, Thrissur District, Kerala – Judgment dated 02.11.2020 in WP(C) No.11048 of 2020 - Revalidation of EC- reg :- (File No. 847/SEIAA/EC1/2859/2015)**

As intimated as per the decision of the 128th SEIAA meeting the Project Proponent Sri. Basil Madappilly, Managing Director, M/s. Vilamana Industries and Sri. P.Z Thomas, Consultant, M/s Environmental Engineers and Consultants attended the hearing. The Consultant made the presentation. During the presentation the Consultant intimated that the project belongs to two villages namely Kuttichira and Kodassery and the mining lease issued is valid only for those Survey Nos fall in Kodassery village, which is not an assigned land. No mining was done in assigned land which falls in Kuttichira village. The Authority decided to direct the Project Proponent to submit a detailed hearing note within 7 days with necessary supporting documents to substantiate his claims.

Item No.129.20 **Terms of Reference (ToR) for the Proposed Granite Building Stone Quarry at Sy.No. (Un Survey) in Kumaranellor Village, Kozhikode Taluk, Kozhikode, Kerala - Judgment dated 10.05.2022 in the WPC No.5545/2021 filed by M/s Mukkom Property Developers (P) Ltd, before the Hon'ble High Court of Kerala. (SIA/KL/MIN/43696/2019 ; File No.1448/EC3/2019/SEIAA)**

The Authority deliberated the item and noted the legal opinion of the Standing Counsel and the Statement filed before the Hon'ble High Court regarding CoC 1067/2023 filed by the petitioner.

The Authority decided to approve the Standard Terms of Reference with the following additional aspects for EIA Study as recommended by SEAC.

1. Vibration studies to evaluate the zone of influence and impact of blasting on the neighbourhood as suggested in para (e) of OM No Z -11013/57/2014-IA.II (M) dated 29-10-2014 of MOEF&CC.
2. Study the Impact on Forest and Wild Life.
3. Study the impact on the hydrology of the region by considering the local rainfall, and seasonal and ground water variations and also propose mitigative / management measures
4. The natural stream which receives the drainage from the project area should be assessed at upstream and downstream regions to maintain its ecological functions.

Item No.129.21 Application for EC for Marath enterprises and Crusher Pvt. Ltd at Survey Nos.: 197/2(p), 198/8(p), 198/9(p) 198/2(p), 198/10(p) & 205/2(p) in Koppam Village, Pattambi Taluk, Palakkad, Kerala - Judgment dated 26.08.2021 in WP (C) No.14476/2021, Judgment dated 22.08.2022 in WP(C) No. 25902 of 2022 & Judgment dated 14.06.2023 & 20.07.2023 in WP(C) No. 10021 of 2023 filed by M/s Marath Enterprises and Crushers Pvt. Ltd (SIA/KL/MIN/273506/2022; 310/SEIAA/KL/1693/2014)

The Authority perused the item and noted the judgment dated 20.07.2023 of the Hon'ble High Court in WP(C) No.10021 of 2023. The Authority also observed the field inspection report of the Sub-Committee of SEAC. The Authority agreed to the non-cluster condition of the project.

Authority decided to refer the proposal to SEAC for further appraisal on priority. The direction of the Hon'ble High Court is compiled herewith and a proceedings shall be issued in this regard.

Item No.129.22 Action Taken Report on 128th meeting of SEIAA held on 27th & 29th June 2023.

Noted

**PROPOSED STANDARD
TERMS OF REFERENCE
(ToR)**

Proposed Standard Terms of Reference for conducting Environment Impact Assessment Study for Non-Coal Mining Projects and the information to be included in EIA / EMP Report.

1. Year-wise production details since 1993-94 should be given, clearly stating the highest production achieved in any one year prior to 1993-94. It may also be categorically informed whether there had been any increase in production after the EIA Notification, 1994 came into force w.r.t. the highest production achieved prior to 1993-94.
 2. A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.
 3. All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.
 4. All corner coordinates of the mine lease area, superimposed on a High Resolution Imagery / toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).
 5. Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.
 6. Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.
 7. It should be clearly stated whether the proponent company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? The hierarchical system or
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administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and / or shareholders or stakeholders at large, may also be detailed in the proposed safeguard measures in each case should also be provided.

8. Issues relating the Mine Safety, including subsidence study in case of underground mining and slope study in case of open case mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.
 9. The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine / lease period.
 10. Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.
 11. Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given.
 12. A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committee.
 13. Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and
-

compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.

14. Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.
 15. The vegetation in the RF / PF areas in the study area, with necessary details, should be given.
 16. A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.
 17. Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger / /Elephant Reserves / (existing as well as proposed), if any, within 10 km of the mine lease should be clarify indicated, supported by a location map duly authenticated by Chief Wildlife Warden, necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished.
 18. A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan alongwith budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.
 19. Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravali Range'. (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining
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Dept. should be secured and furnished to the effect that the proposed mining activities could be considered.

20. Similarly, for coastal projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the mine lease w.r.t. CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).
 21. R&R Plan / compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State / National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs / STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of the line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.
 22. One season (non-monsoon) [i.e. March-May (summer season); October-December (post monsoon season); December-February (winter season)] primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM₁₀, particularly for free silica, should be given.
 23. Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modeling should be provided. The air
-

- quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind directions may also be indicated on the map.
24. The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.
 25. Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.
 26. Description of water conservation measures proposed to be adopted in the Project should be given. Details of rain water harvesting proposed in the Project, if any, should be provided.
 27. Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.
 28. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect ground water table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report interalia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.
 29. Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.
 30. Information on site elevation, working depth, groundwater table etc. should be provided both in AMSL and BGL. A schematic diagram may also be provided for the same.
 31. A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coerage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and covered under plantation and the species to be planted.
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The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.

32. Impact on local transport infrastructure due to the project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.
 33. Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.
 34. Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA Report.
 35. Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.
 36. Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.
 37. Measures of socio economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.
 38. Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of
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agriculture and grazing land, if any, occupational health impacts besides other impacts specified to the proposed project.

39. Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/ EMP Report of the Project
 40. Details of Litigation pending against the project, if any, with direction / order passed by any Court of Law against the Project should be given.
 41. The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.
 42. A Disaster Management Plan shall be prepared and included in the EIA/EMP Report.
 43. Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.
 44. Besides the above, the below mentioned general points are also to be followed:-
 - a. Executive Summary of the EIA / EMP Report.
 - b. All documents to be properly referenced with index and continuous page numbering.
 - c. Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.
 - d. Project Proponent shall enclose all the analysis / testing reports of water, air, soil, noise etc. using the MoEF&CC / NABL accredited laboratories. All the original analysis / testing reports should be available during appraisal of the project.
 - e. Where the documents provided are in a language other than English, an English translation should be provided.
 - f. The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.
 - g. While preparing the EIA Report, the instructions for the Proponents and instructions for the Consultants issued by MoEF vide O.M. No. J-
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11013/41/2006-IA.II (I) dated 4th August, 2009, which are available on the website of this Ministry, should be followed.

- h. Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA / EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.
- i. As per the circular no. J-11011/618/2010-IA.II (I) dated 30.05.2012, certified report of the status of compliance of the conditions stipulated in the environmental clearance for the existing operations of the project, should be obtained from Regional Office of Ministry of Environment, Forests and Climate Change, as may be applicable.
- j. The EIA Report should also include (i) surface plan of the area indicating contours of the main topographic features, drainage and mining area, (ii) geological map and sections and (iii) Sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.

**SCOPE OF THE STUDY AND COMPLIANCE TO THE TERMS of REFERENCE (ToR)
IN THE EIA REPORT FOR THE QUARRY PROJECT OF M/S MUKKOM PROPERTY DEVELOPERS PVT. LTD.**

SPECIFIC ToR CONDITIONS

Sr. No.	Terms of Reference	Brief of the Compliance to the ToR Condition	Reference in the EIA report
1.	<i>Vibration studies to evaluate the zone of influence and impact of blasting on the neighbourhood as suggested in para (e) of OM No Z -11013/57/2014-IA.II (M) dated 29-10-2014 of MOEF&CC.</i>	<ul style="list-style-type: none"> The proposed project is a new quarry project and there are no quarrying operations / blasting operations currently at site. Since the quarry operations can be commenced only after obtaining Environmental Clearance and all other statutory approvals, blasting cannot be carried out now for vibration studies. The PP hereby commit that vibration study will be carried out through a national reputed agency within 3 months from the date of commencement of mining operations. The recommendations to be received from the agency who conducts the vibration study will be followed in letter and spirit. Details are provided at Chapter-4 (Page 4-18). 	Chapter-4
2.	<i>Study the Impact on Forest and Wild Life.</i>	<ul style="list-style-type: none"> The PP has committed to contribute fund to the Forest Department for avoid occurrence of forest fire and also for removal of alien invasive species within the forest area. In the area where the project site is abutting the forest, tree saplings or through other propagation measures in consultation with Forest Department, plantation of species found in the forest area will be developed. In other words, by this measure, eco-restoration of the area currently used as a plantation is ensured. The PP has committed to install hanging solar fencing in consultation with Forest Department in the area abutting the forest land in the east and south direction so as to restrict animals in the ML area. Further details are provided at Chapter-4 (Page 4-19 & Page 4-20). 	Chapter-4
3.	<i>Study the impact on the hydrology of the region by considering the local rainfall, and seasonal and ground water variations and also propose mitigative / management measures</i>	<ul style="list-style-type: none"> A study on ground water of 1 km surrounding of the core zone was carried out and based on which, the ultimate depth of mine is decided. It is observed that the ground water table is in the range of 42.0 MSL – 44.8 MSL. The ultimate depth of mining is fixed at 45 MSL. Hence there is no intersection of ground water table and no impact on hydrogeology. Further details are provided at Chapter-4 (Page 4-11 & Page 4-16). 	Chapter-4

4.	<i>The natural stream which receives the drainage from the project area should be assessed at upstream and downstream regions to maintain its ecological functions”.</i>	<ul style="list-style-type: none"> Assessment of the water quality of natural stream which receives the drainage from the project area. The water quality of the natural drain in the vicinity of the project site (upstream and downstream) will be monitored periodically (once in 3 months) to assess the quality of water. Further details are provided at Chapter-4 (Page 4-12 & Page 4-16). 	Chapter-4
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APPROVED STANDARD ToR CONDITIONS

Sr. No.	Terms of Reference	Brief of the Compliance to the ToR Condition	Reference in the EIA report														
Approved Standard ToRs (Mining)																	
1.	Year-wise production details since 1993-94 should be given, clearly stating the highest production achieved in any one year prior to 1993-94. It may also be categorically informed whether there had been any increase in production after the EIA Notification, 1994 came into force w.r.t. the highest production achieved prior to 1993-94.	Not applicable, As the proposed quarry project is new quarry site.	Chapter1														
2.	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	The proposed quarry is accorded with Letter of Intent (LOI) from Directorate of Mining & Geology, Thiruvananthapuram, Govt. of Kerala vide letter no. 6767/M3/2019 dt. 25-07-2019 (Ref.: Annexure No. 1.1).	Chapter 1														
3.	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	<p>All the figures and write-up in mine plan, EIA Report and Executive Summary for Public Hearing are compatible to each other.</p> <table border="1"> <tr> <td>Mining Technology</td> <td>Open cast mechanized</td> </tr> <tr> <td>Survey Nos., Village, Taluk, District</td> <td>Survey No. (Un survey), Kumaranellor Village, Kozhikode Taluk, Kozhikode District.</td> </tr> <tr> <td>Mine Lease area</td> <td>8.1765 ha.</td> </tr> <tr> <td>Production (Annual)</td> <td>3,00,000 MT (maximum).</td> </tr> <tr> <td>Bench Size</td> <td>5 meters</td> </tr> <tr> <td>Life of mine</td> <td>About 21 years</td> </tr> <tr> <td>Geological Mineral Reserves</td> <td>1,34,95,553 MT</td> </tr> </table>	Mining Technology	Open cast mechanized	Survey Nos., Village, Taluk, District	Survey No. (Un survey), Kumaranellor Village, Kozhikode Taluk, Kozhikode District.	Mine Lease area	8.1765 ha.	Production (Annual)	3,00,000 MT (maximum).	Bench Size	5 meters	Life of mine	About 21 years	Geological Mineral Reserves	1,34,95,553 MT	Chapter 2
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		<table border="1"> <tr> <td>Mineable Reserves</td> <td>62,00,436 MT</td> </tr> <tr> <td>Water requirement</td> <td>The total water requirement is about 35 KLD in which about 7 KLD is for domestic purposes which would be sourced from open well, about 14 KLD for dust suppression mine & about 14 KLD for plantation purposes will be sourced from storm water pond.</td> </tr> <tr> <td>Waste water generation</td> <td>The sewage to a tune of 6 KL will be generated daily from the mine office will be diverted to the septic tank followed by soak pit</td> </tr> <tr> <td>Number of workers as per actual calculation</td> <td>About 50 workers</td> </tr> </table>	Mineable Reserves	62,00,436 MT	Water requirement	The total water requirement is about 35 KLD in which about 7 KLD is for domestic purposes which would be sourced from open well, about 14 KLD for dust suppression mine & about 14 KLD for plantation purposes will be sourced from storm water pond.	Waste water generation	The sewage to a tune of 6 KL will be generated daily from the mine office will be diverted to the septic tank followed by soak pit	Number of workers as per actual calculation	About 50 workers	
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Waste water generation	The sewage to a tune of 6 KL will be generated daily from the mine office will be diverted to the septic tank followed by soak pit										
Number of workers as per actual calculation	About 50 workers										
4.	All corner coordinates of the mine lease area, superimposed on a High Resolution Imagery / toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone)	<ol style="list-style-type: none"> 1. Satellite image with geo-coordinates of the mine lease area is provided at Figure 2.2(Page 2-6). 2. Satellite map showing important features within 10 km radius is provided as Figure 2.3 (Page 2-7). 3. Toposheet map showing location of project site & important features within 10 km radius is provided as Figure 2.4 (Page 2-8). 4. Land use / Land cover within 500m for ML area (Figure 3.6, Page 3-23) 5. Land use / Land cover map of Karassery Grama Panchayat with marking of ML boundary (Figure 3.7, Page 3-24) 6. Satellite image showing core zone & buffer zone for impact assessment and baseline monitoring (Figure 3.1) (Page 3-2). 7. Geology of the area (Page 3-6 to 3-9) 	Chapter 2 & Chapter 3								
5.	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	<ul style="list-style-type: none"> • The project site is falling in Toposheet (No. C43E03). The Toposheet map showing location of project site with important features within 10 km radius is provided as Figure 2.4 (Page 2-8). • Satellite map showing important features within 10 km radius is provided as Figure 2.3 (Page 2-7). 	Chapter 2 & Chapter 3								

		<ul style="list-style-type: none"> The soil characteristics details are provided in Chapter 3 (Page 3-20 to 3-21) 	
6.	<p>Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.</p>	<ul style="list-style-type: none"> The proposed quarry is accorded with Letter of Intent (LOI) from Directorate of Mining & Geology, Thiruvananthapuram, Govt. of Kerala vide letter no. 6767/M3/2019 dt. 25-07-2019 (Ref. : Annexure No. 1.1) As per the Non-Assignment certificates from Village Office, Kumaranellur stating that this land is not assigned for any special purposes, not involved in reserve forests, there is no court / bank attachments, this land is not in right of Schedule Tribe. Also, there is no Schedule Settlements within 500 meters from the periphery of project boundary. (Ref. : Annexure No. 3.3). 	Chapter 1 & Chapter 3
7.	<p>It should be clearly stated whether the proponent company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and / or shareholders or stakeholders at large, may also be detailed in the proposed safeguard measures in each case should also be provided.</p>	<ul style="list-style-type: none"> The lessee (project proponent) will adopt Environmental Management System (EMS) which will assist the management to meet both current and future environmental requirements and challenges. The detail regarding objectives, role and responsibilities, SOP etc, about the Environmental Management System is provided in Chapter - 10 of EIA Report. 	Chapter-10
8.	<p>Issues relating the Mine Safety, including subsidence study in case of underground mining and slope study in case of open case mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.</p>	<ul style="list-style-type: none"> The proposed quarry is minor mineral (granite building stone) mining (quarry) project by open cast mining method. Further, details regarding mine safety, mining method and slope study etc. is provided in Chapter-2 & Chapter-3. 	Chapter 2 & Chapter 3

9.	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine / lease period.	<ul style="list-style-type: none"> • Study area is 10 km. radius from the mine lease area and the detail are provided EIA Report. • Life of Mine – about 21 years • Liquid waste – 6 KLD • Solid waste – about 26 kg/day (13 kg domestic + 13 kg packing & other solid waste) • Top soil / O.B. – 2,49,539 MT 	Chapter 2 & Chapter 3
10.	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	<ul style="list-style-type: none"> • The details of Environment Setting of the project is provided at Table 2.3 (Page 2-13) • Land use / Land cover within 500m for ML area (Figure 3.6, Page 3-23) • Land use / Land cover map of Oorakam Grama Panchayat with marking of ML boundary (Figure 3.7, Page 3-24) • There is no Wildlife Sanctuary / National Park within the study area. • The relevant maps of the mine plan (Production and Development Plan with Section, Conceptual Plan with Section) regarding Land use of the mine lease area is provided in Chapter 2 [Ref. Annexure No. 2.4 (A & B) & 2.5 (A & B)]. • The details of impact of land use is provided in Chapter 4 (Page 4-3 to 4-4) & mitigation measures are provided at Page No. 4-9 to 4-10. 	Chapter 2, Chapter 3 & Chapter 4
11.	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given.	<ul style="list-style-type: none"> • Top soil / O.B. = 2,49,539 MT • Area is earmarked for storage of top soil / Overburden dumps outside the mining area (Figure 4.2, Page 4-15). • The land for the proposed quarry is private own land and with mixed plantation (predominantly rubber) and without any human habitation. Therefore there is no displacement of people from the core zone of the project, hence Rehabilitation & Resettlement (R & R) is not applicable to the instant project. (Page 7-10). 	Chapter 3, Chapter 4 & Chapter 7
12.	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status	<ul style="list-style-type: none"> • The proposed land (8.1765 ha.) is private own land and there is no forest land involved in the proposed land. There is a forest boundary in the east and south direction at a distance of about 101 meter. • As per the Non-Assignment certificates from Village Office, 	Chapter-2 & Chapter-3

	of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committee.	Kumaranellur stating that this land is not assigned for any special purposes, not involved in reserve forests, there is no court / bank attachments, this land is not in right of Schedule Tribe. Also, there is no Schedule Settlements within 500 meters from the periphery of project boundary. (Ref. : Annexure No. 3.3 and Annexure No. 1.4).	
13.	Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	<ul style="list-style-type: none"> • Not applicable. • The proposed land (8.1765 ha.) is private own land and there is no forest land involved. 	Chapter 1, 2 & 3
14.	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	<ul style="list-style-type: none"> • Not applicable. • The proposed land (8.1765 ha.) is private own land and there is no forest land involved. • As per the Non-Assignment certificates from Village Office, Kumaranellur stating that this land is not assigned for any special purposes, not involved in reserve forests, there is no court / bank attachments, this land is not in right of Schedule Tribe. Also, there is no Schedule Settlements within 500 meters from the periphery of project boundary. (Ref. : Annexure No. 3.3 and Annexure No. 1.4). 	Chapter 1, 2 & 3
15.	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	<ul style="list-style-type: none"> • The vegetation details in core zone and buffer zone is provided in Chapter 3. • There is a forest boundary in the east and south direction at a distance of about 101 meter. • Vested forest is located within about 1 km (SW) 	Chapter 2
16.	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	<ul style="list-style-type: none"> • There is no Wildlife Sanctuary or National Park located within the study area. • The Ecological Assessment details is provided in Chapter-3 and Impact & Mitigation measures are provided at Chapter-4 	Chapter 2, 3 & Chapter 4
17.	Location of National Parks, Sanctuaries, Biosphere Reserves,	<ul style="list-style-type: none"> • There is no National Parks, Sanctuaries, Biosphere Reserves, Wildlife 	Chapter 2

	Wildlife Corridors, Ramsar site Tiger / Elephant Reserves / (existing as well as proposed), if any, within 10 km of the mine lease should be clarify indicated, supported by a location map duly authenticated by Chief Wildlife Warden, necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished.	Corridors, Ramsar site Tiger / Elephant Reserves / (existing as well as proposed) located within 10 km of the mine lease.	
18.	A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	<ul style="list-style-type: none"> • Ecological Assessment of the core zone and buffer zone (10 km. radius) (study area) is prepared and provided in Chapter-3 (Page 3-53 to 3-63). 	Chapter 3
19.	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravali Range'. (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Dept. should be secured and furnished to the effect that the proposed mining activities could be considered.	<ul style="list-style-type: none"> • There is no 'Critically Polluted' or the area comes under the 'Aravali Range' available within study area. 	Chapter 2
20.	Similarly, for coastal projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the mine lease w.r.t. CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The	<ul style="list-style-type: none"> • Not applicable. 	Chapter 3

	Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).		
21.	R&R Plan / compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State / National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs / STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of the line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	<ul style="list-style-type: none"> • Rehabilitation and Resettlement (R&R) plan (Page 7-10) – Not applicable to the instant project. There is no displacement of people from the core zone of the project. There is no habitation located within the mine lease area. 	Chapter 7
22.	One season (non-monsoon) [i.e. March-May (summer season); October – December (post monsoon season); December – February (winter season)] primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM ₁₀ , particularly for free silica, should be given.	<ul style="list-style-type: none"> • Predominant Wind Location:- As per wind rose diagram, the predominant wind direction is from North West to South East direction. Refer Figure 3.22 (Page 3-77). • Ambient Air Monitoring:- Sampling locations were selected within the study area i.e. one sample at core zone and other locations at sensitive receptors (schools/college) located within the 1.5 km from the mine lease area (Total 6 samples) from the boundary of mine lease area were carried out in September, October, November, 2023 • Ambient Noise :- 6 Samples. • Water :- Open wells water near site (2 samples) & Surface Water (2 samples) • Soil sample :- One from Core zone (lower portion) and Other three from Buffer zone within 0.5 km (study area) 	Chapter 3

		<p>(influence zone) (Total 4 samples) by NABL accredited lab and one from the proposed compensatory plantation area by Soil Testing Laboratory, Agriculture Department.</p> <ul style="list-style-type: none"> • Analysis report of PM10 showing value of free silica is provided at Table 3.35 (Page 3-84). • Ecological Assessment:- Core zone and buffer zone separately. • Socio-economic environment :- All Local Self Govt. areas within 10 km radius. 	
23.	<p>Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modeling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind directions may also be indicated on the map.</p>	<ul style="list-style-type: none"> • Modeling studies were carried out. (Ref. Annexure 4.2). 	Chapter 4
24.	<p>The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.</p>	<ul style="list-style-type: none"> • Source :- Rain water and open well water. • Water requirement (Page 2-14) :- The total water requirement is about 35 KLD in which about 7 KLD is for domestic purposes which would be sourced from open well, about 14 KLD for dust suppression mine & about 14 KLD for plantation purposes will be sourced from storm water pond. 	Chapter 2
25.	<p>Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.</p>	<ul style="list-style-type: none"> • Total of about 7 KLD is for domestic purposes which would be sourced from open well. No permission is required for wells. 	Chapter 2
26.	<p>Description of water conservation measures proposed to be adopted in the Project should be given. Details of rain water harvesting proposed in the Project, if any, should be provided.</p>	<ul style="list-style-type: none"> • Water Conservation measures :- • It is proposed to construct a storm water collection pond (about 8 KL) (pre-mining) to store rain water from the site and use it for sprinkling and green belt development. Also in the conceptual stage, the mining area will be developed as pond with partially green area. 	Chapter 2 & Chapter 4

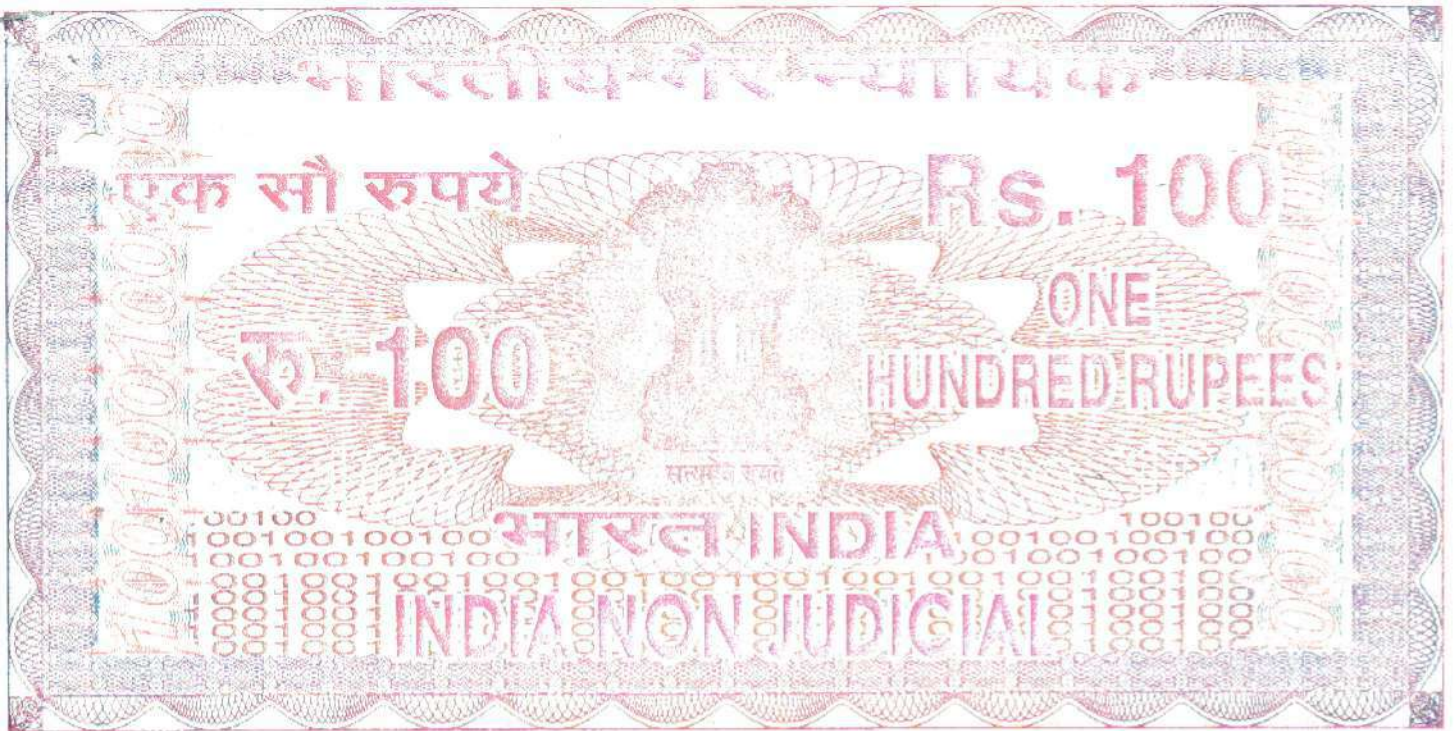
27.	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	<ul style="list-style-type: none"> All Impacts of the mining on water environment is provided (both surface and ground water) at Chapter 4. 	Chapter 4
28.	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect ground water table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report interalia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.	<ul style="list-style-type: none"> Hydro geological study was carried out in the immediate vicinity project site and the details are provided at Chapter-3 (Page 3-34 to 3-37). From the geological study, there is no intersect the ground water table. 	Chapter 3
29.	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.	<ul style="list-style-type: none"> No stream, perennial or seasonal passing through mine lease area. Refer Map showing the Land Use / Land cover map of the quarry site within 500 m. radius. (Figure 3.6) (Page 3-23). There is a seasonal drain located outside the ML area which is located west direction. Impacts & its Mitigation Measure are provided in Chapter-4 	Chapter 3 & Chapter 4
30.	Information on site elevation, working depth, groundwater table etc. should be provided both in AMSL and BGL. A schematic diagram may also be provided for the same.	<ul style="list-style-type: none"> Site elevation :- Highest Level = 195 AMSL (E) (near BP7&8) Lowest Level = 60 AMSL (NW) (near BP1) Working level of benches in conceptual phase=190 AMSL to 45 AMSL The working plans (Production and Development Plan with Section and Conceptual Plan with Section) to show the depth of mining is provided at Annexure No. 2.4(A &B) & Annexure No. 2.5(A&B). 	Chapter 2
31.	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and covered under plantation and the species to be planted. The details of plantation already done	<ul style="list-style-type: none"> The details are provided in Production and Development Plan with Section and Conceptual Plan with Section to show the depth of mining is provided at Annexure No. 2.4(A &B) & Annexure No. 2.5(A&B). Green belt development plan & Eco restoration plan with native Plant Species is provided at Chapter 4 (Page 4-19 to 4-29). 	Chapter 2 & Chapter 4

	should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.		
32.	Impact on local transport infrastructure due to the project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.	<ul style="list-style-type: none"> The Traffic study of the access roads is carried out and details are provided at Chapter 3 (Table 3.36) (Page 3-85 to 3-90) 	Chapter 3.
33.	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	<ul style="list-style-type: none"> Onsite shelter and facilities for about 50 mine workers will be provided in the land owned by the project proponent abutting the proposed mine lease area. 	Chapter 2
34.	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA Report.	<ul style="list-style-type: none"> The relevant maps (plates of mine plan) are provided at Annexure No. 2.4(A &B) & Annexure No. 2.5(A&B) Land use of ML area (pre-operation, operational for next 5 year & post operational for life of mine) is provided (Table 4-4, Page 4-10) 	Chapter-2 & Chapter 4
35.	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	<ul style="list-style-type: none"> Detail of Occupational Health with budgetary allocation is provided in Chapter-6 and budgetary allocation is provided in Table 6.1. 	Chapter-6
36.	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be	<ul style="list-style-type: none"> Assessment of Impacts on socio-economic environment with mitigation measures are provided in Chapter 4 and budgetary allocations in Chapter-10. 	Chapter-4 & Chapter-10

	detailed along with budgetary allocations.		
37.	Measures of socio economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	<ul style="list-style-type: none"> • Need assessment study near the project site was carried out and CER activities as per norms with budgetary allocation are provided in Chapter-7 (Page 7-10 to Page 7-16) 	Chapter-7
38.	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agriculture and grazing land, if any, occupational health impacts besides other impacts specified to the proposed project.	<ul style="list-style-type: none"> • The proposed land is private own land with mixed plantation (predominantly rubber plantation). There is no agriculture and grazing land. • The Environment Management Plan and the measures to mitigate the impacts for each facet of Environment are provided in Chapter-4 & Chapter-10. 	Chapter 4 & Chapter 10
39.	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/ EMP Report of the Project.	<ul style="list-style-type: none"> • Public hearing comments will be incorporated in the final EIA (Page 7-1). 	Chapter 7
40.	Details of Litigation pending against the project, if any, with direction / order passed by any Court of Law against the Project should be given.	There is Court Case pending against the project vide WP(C) No. 13031/2019 before High Court of Kerala. The Interim Order dt. 27-05-2019 passed by the High Court of Kerala is provided at Annexure No. 12.3.	
41.	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	<ul style="list-style-type: none"> • Cost of the project – Rs. 12.197 Crores. • The capital cost for implementation of schemes under Environment Management Plan is provided in Chapter 10. 	Chapter 10
42.	A Disaster Management Plan shall be prepared and included in the EIA/EMP Report.	<ul style="list-style-type: none"> • The disaster management plan is provided in Chapter-7 (Page 7-1 to 7-10). 	Chapter 7
43.	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	<ul style="list-style-type: none"> • Details are provided in Chapter-8 (Page 8-1 to 8-2) 	Chapter 8
44.	Besides the above, the below mentioned general points are also to be followed: -	-	General Instruction
	a. All documents to be properly referenced with index and	<ul style="list-style-type: none"> • Index and continuous Page numbers are provided in the EIA Report 	Complied

	continuous page numbering.		
	b. Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	<ul style="list-style-type: none"> • Period of data (vintage) and source of data is provided. 	Provided
	c. Project Proponent shall enclose all the analysis / testing reports of water, air, soil, noise etc. using the MoEF&CC / NABL accredited laboratories. All the original analysis / testing reports should be available during appraisal of the project.	<ul style="list-style-type: none"> • All baseline monitoring was carried out through NABL accredited laboratory and the reports (clear scanned copies) are attached with the EIA report. 	Provided
	d. Where the documents provided are in a language other than English, an English translation should be provided.	<ul style="list-style-type: none"> • Complied. 	Complied
	e. The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	<ul style="list-style-type: none"> • Complied. 	Complied
	f. While preparing the EIA Report, the instructions for the Proponents and instructions for the Consultants issued by MoEF vide O.M. No. J-11013/41/2006-IA.II (I) dated 4 th August, 2009, which are available on the website of this Ministry, should be followed.	<ul style="list-style-type: none"> • Complied. 	Complied
	g. Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA / EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.	<ul style="list-style-type: none"> • Complied. 	Complied
	h. As per the circular no. J-11011/618/2010-IA.II (I) dated 30.05.2012, certified report of the status of compliance of the conditions stipulated in the environmental clearance for the existing operations of the project, should be	<ul style="list-style-type: none"> • Not applicable. New quarry proposal 	Chapter 1

	<p>obtained from Regional Office of Ministry of Environment, Forests and Climate Change, as may be applicable.</p>		
	<p>i. The EIA Report should also include (i) surface plan of the area indicating contours of the main topographic features, drainage and mining area, (ii) geological map and sections and (iii) Sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.</p>	<ul style="list-style-type: none"> • The topographical contour map of the mine lease area showing contour levels of the mine lease area which is provided at Figure 3.5 (Page 3-22). • Surface cum Geological Plan is provided at Figure 3.11(A) & 3.11(B) (Page 3-30 & 3-31) • Drainage plan of the proposed mine lease area is provided at Figure 4.1 (Page 4-14). • The Environment Plan of the proposed mine lease area is showing the dumping area is provided at Figure 4.2 (Page 4-15) • The other Relevant Mine Plates (Production and Development Plan with Section and Conceptual Plan with Section) of the proposed quarry project provided at Annexure No. 2.4(A) & (B) & Annexure No. 2.5 (A) & (B). 	<p>Chapter-2, 3 & 4</p>



കേരളം കേരള KERALA

BV 276413

സമ്മത പത്രം

2018-ാം ആണ്ട് നവംബർ മാസം 5-ാം തിയ്യതി കോഴിക്കോട് ജില്ലയിൽ കോഴിക്കോട് താലൂക്കിൽ ചാത്തമംഗലം വില്ലേജിൽ ചീനത്താംകുഴി അഹമ്മദ് മകൻ സി.കെ. അബ്ദുൾ അസീസ് 45 വയസ്സ് ചീനത്താംകുഴി വീട്, മലയമ്മ പി.ഒ എന്നയാൾ ശ്രീ. സി.കെ. അബ്ദുൾ അസീസ് മാനേജിംഗ് ഡയറക്ടർ, മുക്കം പ്രോപ്പർട്ടി ഡെവലപ്മെന്റ് പ്രൈവറ്റ് ലിമിറ്റഡ് ചാത്തമംഗലം പി.ഒ. എന്ന കമ്പനിക്ക് എഴുതികൊടുക്കുന്ന സമ്മതപത്രം.

എന്റെ ഉടമസ്ഥതയിലും കൈവശത്തിലിരിക്കുന്നതും മുക്കം സബ് രജിസ്ട്രാർ ഓഫീസിൽ 3115/1/2015 (1.2091 ഹെക്ടർ) , 3114/1/2015 (1.2091 ഹെക്ടർ),



C.K. ABUL AZEER
A



No. 19745 Kerala R...
Name...
Date...
S.R.O VENDER, MUKKAM(Ag)
HINDHU.K.

കോഴിക്കോട് ചാത്തമംഗലം
അബ്ദുൾ അസീസ്
ANWAR SADIQUE.V.K B.A., LLB
ADVOCATE & NOTARY
Roll No. K/235/1999
Mukkam, Kozhikode District
Kerala State, India - 673 602



കേരളം കേരള KERALA

BV 276414

3105/1/2015 (1.2091 ഹെക്ടർ) നമ്പർ ആധാരപ്രകാരം കോഴിക്കോട് ജില്ലയിൽ കോഴിക്കോട് താലൂക്കിൽ കുമാരനെല്ലൂർ വില്ലേജിൽ അൻസർവ്വേയിൽപ്പെട്ട 3.6273 ഹെക്ടർ സ്ഥലങ്ങളിൽ ഉൾപ്പെട്ട 3.2169 ഹെക്ടർ സ്ഥലങ്ങളിൽ നിന്നും കരിങ്കല്ല് ഖനനം ചെയ്ത് വിൽപ്പന നടത്തുന്നതിന് മൈനിംഗ് & ജിയോളജി വകുപ്പിൽ നിന്നും ക്വാറിംഗ് ലീസ് അനുവദിച്ചു എക്സിക്യൂട്ടീവ് ചെയ്യുന്ന തീയതി മുതൽ 10 വർഷത്തേക്ക് താഴെ പേരെഴുതി ഒപ്പിട്ടിരിക്കുന്ന രണ്ട് സാക്ഷികൾ മുമ്പാകെ സ്വമനസ്സാലെ പൂർണ്ണമായും സമ്മതിച്ചിരിക്കുന്നു.

സാക്ഷികൾ

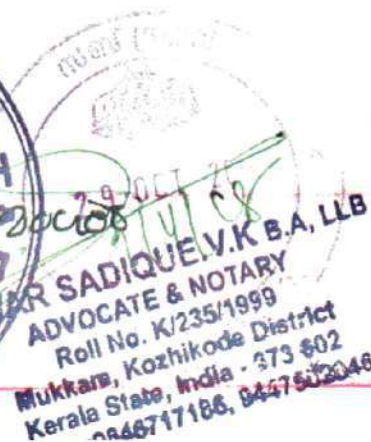
1. നിനാജുദ്ദീൻ. മുനാജ്ജർ
 3/o മുനാജ്ജർ, അമ്മൂർക്കി P.O

സ്ഥലം ഉടമയുടെ പേരും ഒപ്പും

2. മുനാജ്ജർ അബ്ദുൽ റഹ്മാൻ
 8/o അബ്ദുൽ റഹ്മാൻ KT, മേലൂർ Po
Aslal

C.K. ABDUL AZEER
(Aad)

No. 19741..Kerala Rs...100
 Name.....*നി. കെ. അബ്ദുൽ റഹ്മാൻ*
 Date.....*2/11/2018*
 S.R.O VENDER, MUKKAM(Ag)
 SINDHAN K



FORM 12 C
(See Rule 3)



GOVERNMENT OF KERALA
KUMARANALLUR VILLAGE OFFICE
POSSESSION CERTIFICATE

No. 66877552

Date: 03/08/2022

Name of Person to whom certificate is issued	MANAGING DIRECTOR MUKKAM PROPERTY DEVELOPERS PRIVATE LIMITED
Name of Father	AHAMMED
Address	CHEENATHAMKUZHIYIL, 0, MALAYAMMA
Post Office with PIN Code	MALAYAMMA, 673601
District	Kozhikode

Certified that land shown in the schedule below are in possession and enjoyment of the person

Taluk / Village	Old Survey No	Re-Survey Block	ReSurvey No	Extend in Ha	Thandapper No	Thandapper Name	Class of Land
Kozhikode/ Kumaranallur		001	153/1439	1.8211	3538		us
Kozhikode/ Kumaranallur		001	153/1438	1.8211	3538		us
Kozhikode/ Kumaranallur		001	153/1437	1.2303	3538		us
Kozhikode/ Kumaranallur		001	153/1436	0.0587	3538		us
Kozhikode/ Kumaranallur		001	153/1435	0.3581	3538		us

Certificate Issued Date	03/08/2022
Designation of the Issuing officer	Village Officer
Purpose for which the certificate is issued for	MINING AND GEOLOGY DIRECTOR THIRUVANANDHAPURAM
Remarks	Nil

Security Code : 1N9M9

NOTE:

1. This digitally signed document is legally valid as per the Information Technology (IT) Act, 2000.
2. Authenticity of this document can be verified from <http://edistrict.kerala.gov.in/> and submitting the Certificate Number and Security code. Alternatively, please call the numbers 155300(from BSNL landline), 0471155300(from BSNL mobile), 04712335523/04712115094/04712115098(from other networks) and quote the Certificate Number to the operator.



GOVERNMENT OF KERALA
KUMARANALLUR VILLAGE OFFICE
POSSESSION CERTIFICATE

No. 66877552

Date: 03/08/2022

This certificate is issued based on the details given in the application, local enquiry, facts and records produced.

Security Code : 1N9M9

Digitally signed by NAJMUL HUDA K C
Date:03-08-2022 16:31:39

NOTE:

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**GOVERNMENT OF KERALA
KUMARANALLUR VILLAGE OFFICE
POSSESSION CERTIFICATE**

No. 66899915

Date: 04/08/2022

Name of Person to whom certificate is issued	ABDUL AZEEZ
Name of Father	AHAMMED
Address	CHEENATHAMKUZHI, 0, MALAYAMMA
Post Office with PIN Code	MALAYAMMA, 673601
District	Kozhikode

Certified that land shown in the schedule below are in possession and enjoyment of the person

Taluk / Village	Old Survey No	Re-Survey Block	ReSurvey No	Extend in Ha	Thandapper No	Thandapper Name	Class of Land
Kozhikode/ Kumaranallur		001	153/1433	1.2141	2571		us
Kozhikode/ Kumaranallur		001	153/1432	1.2141	2571		us
Kozhikode/ Kumaranallur		001	153/1431	1.2141	2571		us

Certificate Issued Date	04/08/2022
Designation of the Issuing officer	Village Officer
Purpose for which the certificate is issued for	MINING AND GEOLOGY DIRECTOR THIRUVANANDHAPURAM
Remarks	Nil

This certificate is issued based on the details given in the application, local enquiry, facts and records produced.

Security Code : C7F67

Digitally signed by NAJMUL HUDA K C
Date:04-08-2022 14:00:46

NOTE:

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BRIEF DETAILS OF MACHINERY

SINGLE SHIFT WORKING - 8 hrs.

Requirement of machineries :-

The calculation for requirement of different machineries to handle required production of 3,00,000 Ton of mineral or 1,000 TPD are given below:-

Drilling

The drilling of holes is proposed in one shift.

Drilling rate	=	5 m/ hr
Utilization of time	=	7 hrs/day in single shift
Depth of holes	=	1.5 m
Burden	=	1.5 m
Spacing	=	2.5 m
Specific gravity	=	2.5
Rocks broken per hole	=	sp. Gravity x spacing x burden x depth
	=	2.5 x 2.5 x 1.5 x 1.5
	=	14.0625 MT

Therefore, for 1000 MT/Day

So, $1000/14 = 71.43$ holes required /day

Total meterage of
drilling required / day = depth of hole x no. of holes
= 1.50×71.43
= 107.14 m/day say 107 m per day

Capacity of one drill machine = 5×7
= 35 m per day

For 107 m drilling

no of machines required = $107 / 35$
= **3.05 say 3 jackhammers.**

Excavators

The loading capacity of an excavator can be calculated with the following equation

$$(L) = B \times R \times N \times T \times E/K$$

Here

- L = Loading capacity/shift
B = Bucket capacity = 0.9 cu.m i.e. 0.72 cu.m. @ 80%
R = Co-efficient of filling (assumed 0.8)
N = Average no. of loading cycle/hrs (assumed 120 cycle/ hr of 30 second each)
T = No. of effective working hrs/shift= 7 hrs
E = Efficiency of utilization (assumed 0.8)
K = Swelling factor (taken 1.6)
L = $0.72 \text{ cu.m.} \times 0.80 \times 120 \text{ cycle/hr} \times 7 \text{ hr} \times 0.8/1.6$
= 241.92 cu.m. / shift / excavator

Daily ROM granitic building stone = $1000 / 2.5 \times 1.6 = 640 \text{ cu.m}$

Requirement of no. of excavators = $640 / 241.92 \text{ cu.m.}$

= 2.65 or say to 3 nos and one

machine shall be standby, so total

machines will be 3+1=4 **Excavators**

Dumpers Cycle time of dumper:

Spotting time = 1 min.

Loading time = 3.5 min

Travel time

(loading to unloading) = 24.5 min

Unloading time = 1 min

Total time = 30 min

Utilization time = 7 hrs

No of trips/day/dumpers = $7 \times 60 / 30 = 14 \text{ trips}$

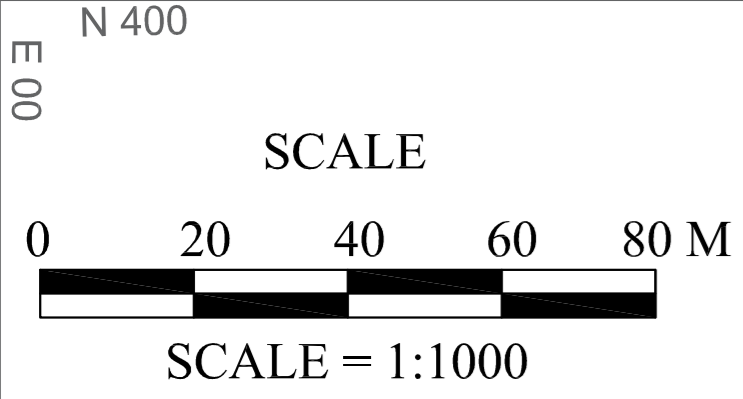
Tonnage per day / dumper = $14 \times 15 \text{ MT} = 210 \text{ MT}$

ROM handling /day = 1000 MT

No. of dumpers = $1000/ 210 = 4.76$ or say to 5 dumpers

Note- 1 dumpers of 10 ton capacity will be used for transportation of soil as well as for miscellaneous operations.

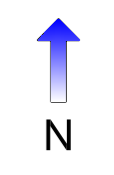
Total No. of dumpers = $5 + 1 = 6 \text{ dumpers}$



Annexure No. 2.4(A)

PLATE No. 4

PRODUCTION & DEVELOPMENT PLAN

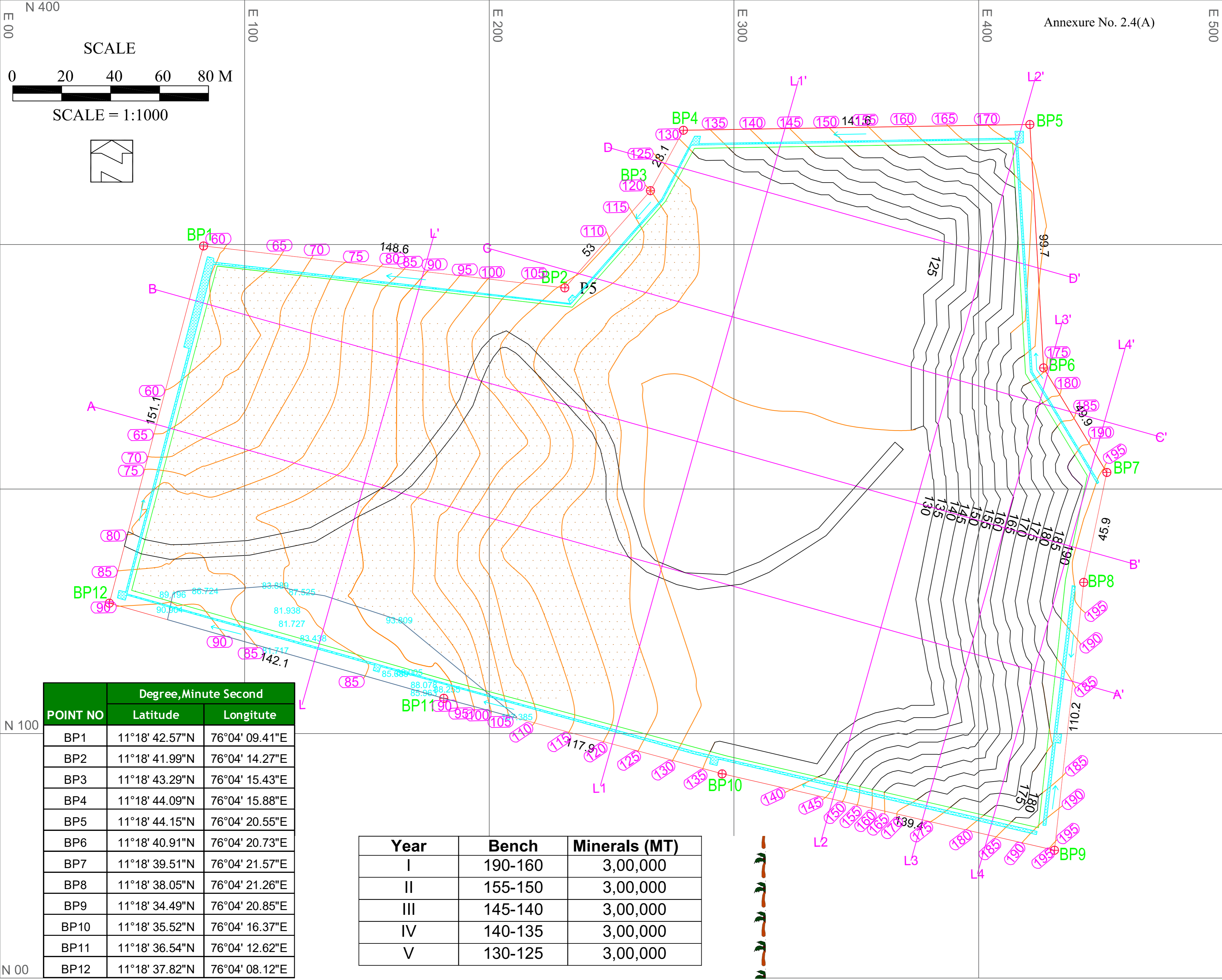


INDEX

- LEASE BOUNDARY WITH FENCING
- SOIL
- GRANITE ROCK
- CONTOUR LINE
- SECTION LINE
- MINE SAFETY BARRIER LINE
- GREEN BELT
- RECLAIMED AREA
- BOUNDARY PILLAR
- PLANTATION
- WORKING BENCH
- RAIN WATER WAY
- ROAD
- OLD PIT

Project Name :- M/s. MUKKAM PROPERTY DEVELOPERS PVT. LTD.
 Village :- KUMARANELLOR
 Taluk :- KOZHIKODE
 District :- KOZHIKODE
 State :- KERALA
 Plot area :- 08.1765 Ha.

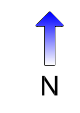
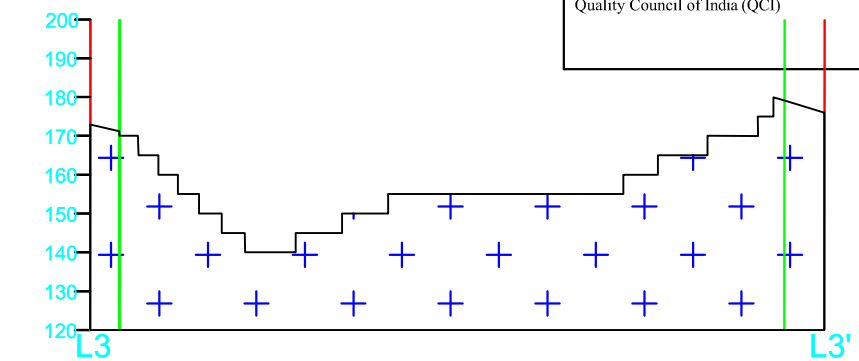
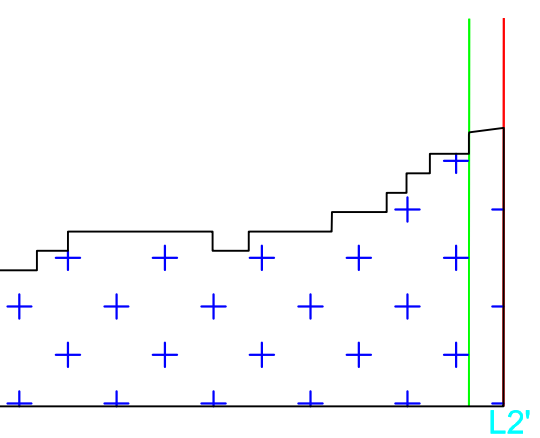
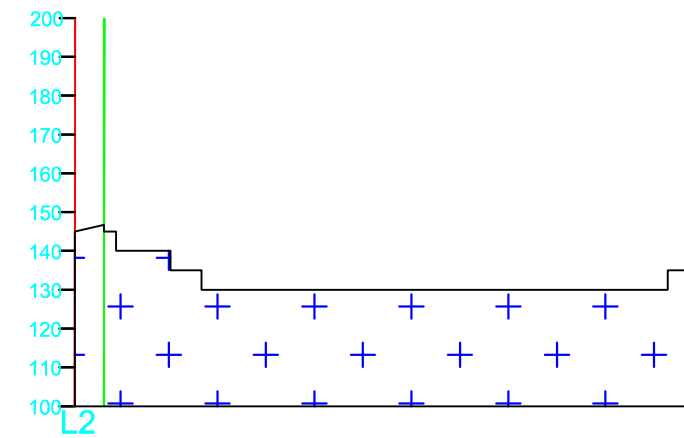
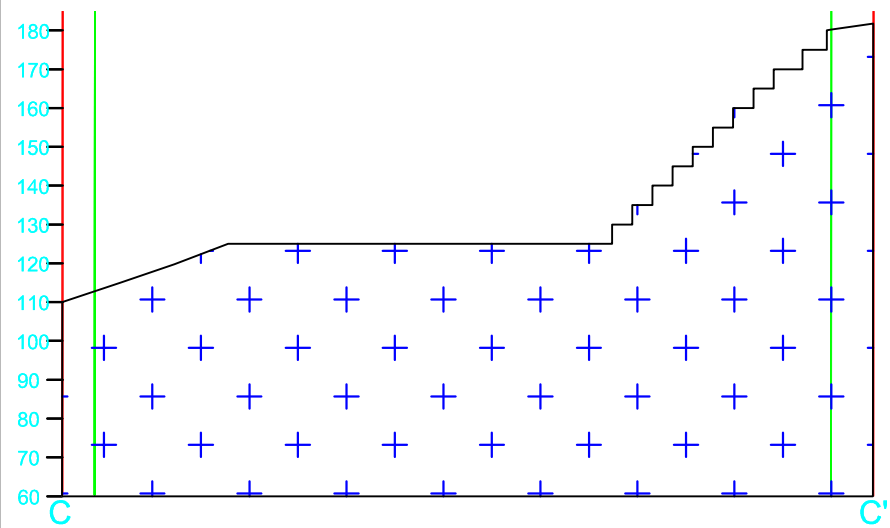
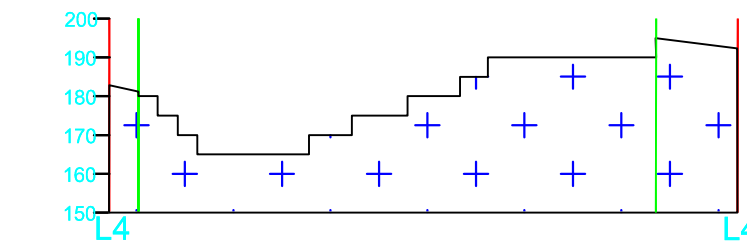
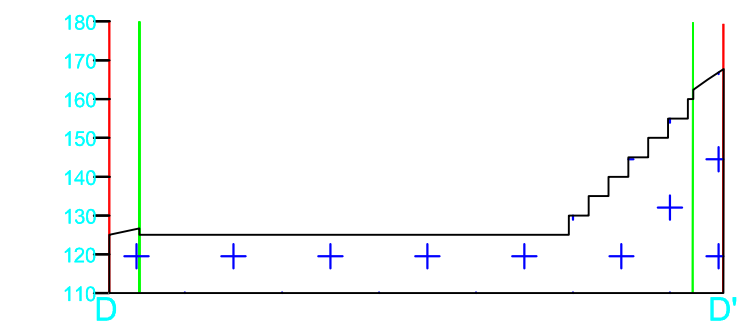
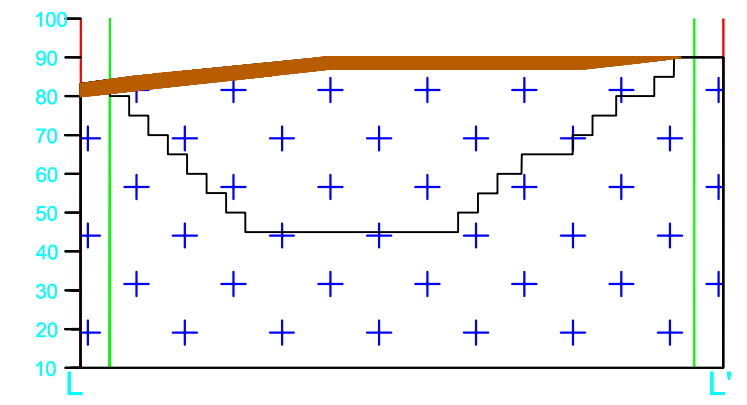
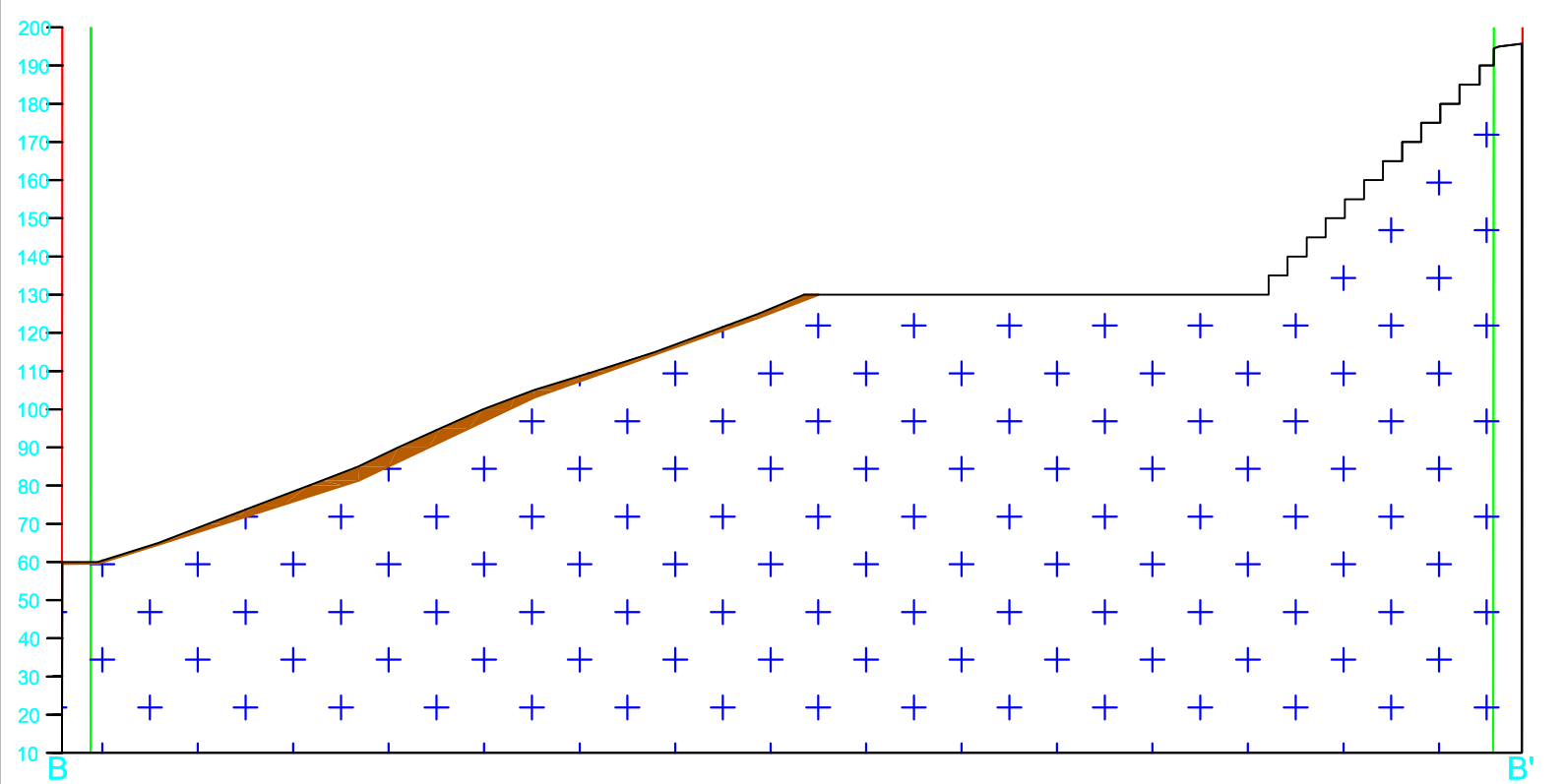
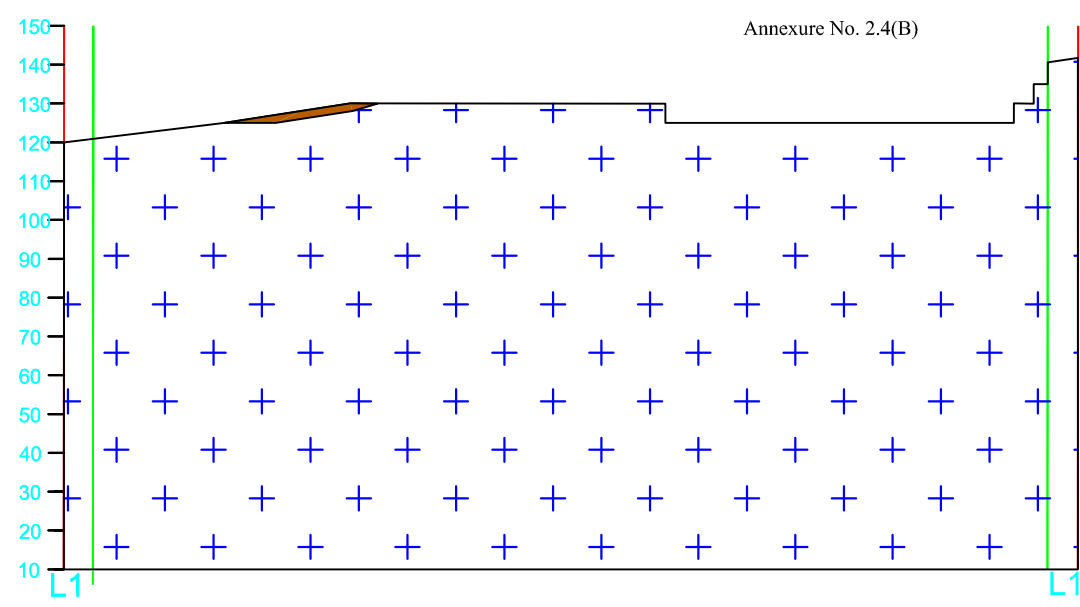
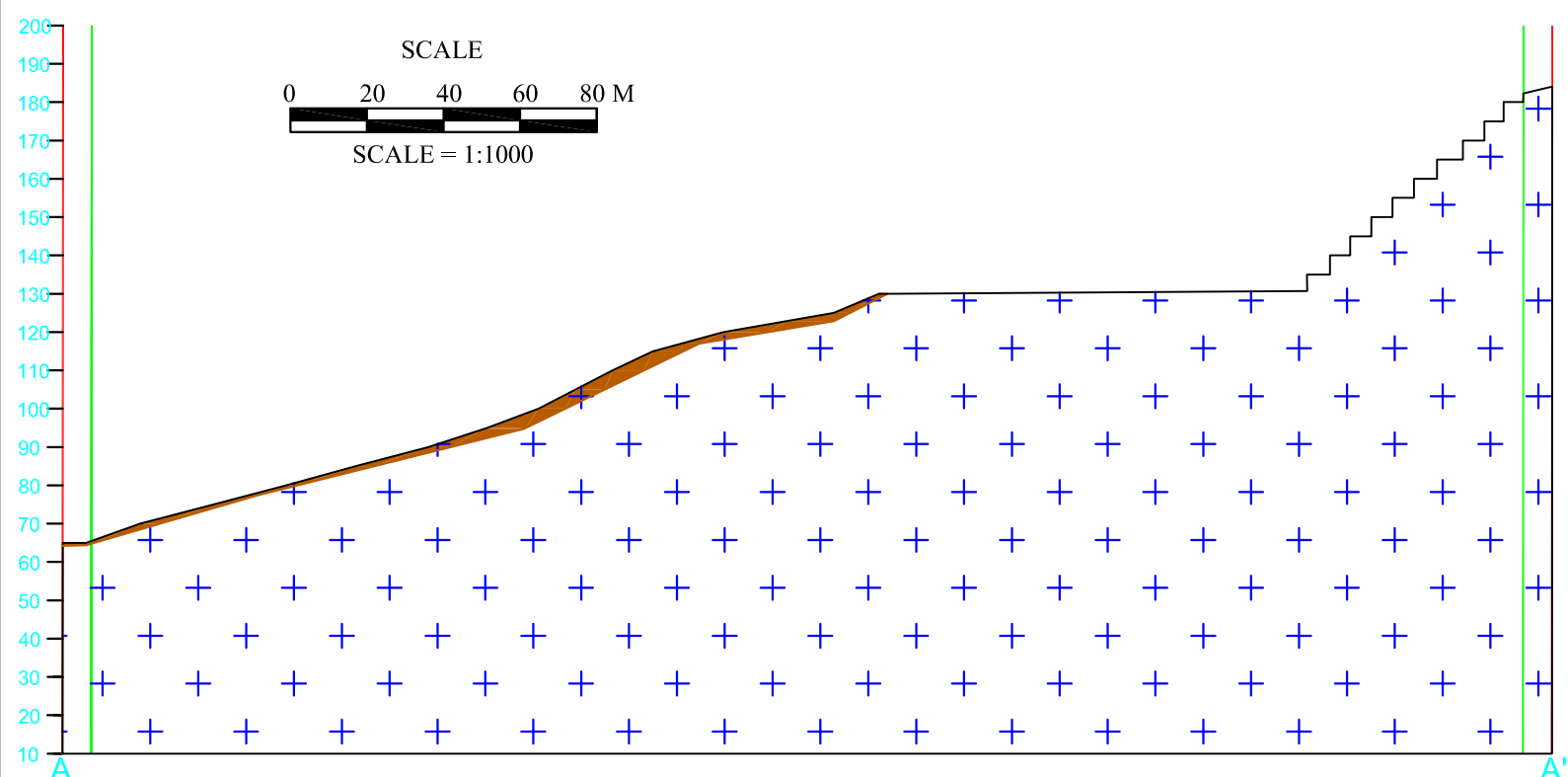
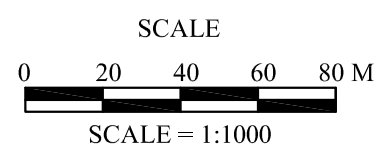
MUKESH SUROLIYA,
 M.Sc. Geology,
 Recognition as Qualified Person (RQP),
 (RQP No. -DMG/KERALA/RQP/24/2020)
 Accredited Functional Area Expert (FAE),
 Hydrology & Ground Water (HG) and
 Geology (GEO) from National Accreditation
 Board for Education and Training (NABET),
 Quality Council of India (QCI)



POINT NO	Degree, Minute Second	
	Latitude	Longitude
BP1	11°18' 42.57"N	76°04' 09.41"E
BP2	11°18' 41.99"N	76°04' 14.27"E
BP3	11°18' 43.29"N	76°04' 15.43"E
BP4	11°18' 44.09"N	76°04' 15.88"E
BP5	11°18' 44.15"N	76°04' 20.55"E
BP6	11°18' 40.91"N	76°04' 20.73"E
BP7	11°18' 39.51"N	76°04' 21.57"E
BP8	11°18' 38.05"N	76°04' 21.26"E
BP9	11°18' 34.49"N	76°04' 20.85"E
BP10	11°18' 35.52"N	76°04' 16.37"E
BP11	11°18' 36.54"N	76°04' 12.62"E
BP12	11°18' 37.82"N	76°04' 08.12"E

Year	Bench	Minerals (MT)
I	190-160	3,00,000
II	155-150	3,00,000
III	145-140	3,00,000
IV	140-135	3,00,000
V	130-125	3,00,000

PRODUCTION & DEVELOPMENT PLAN SECTION



INDEX

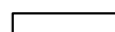
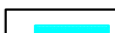

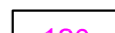
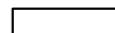
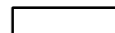




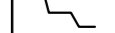

- LEASE BOUNDARY WITH FENCING
- SOIL
- GRANITE ROCK
- CONTOUR LINE
- SECTION LINE
- MINE SAFETY BARRIER LINE
- WORKING BENCH

Project Name :- M/s. MUKKAM PROPERTY DEVELOPERS PVT. LTD.
 Village :- KUMARANELLOR
 Taluk :- KOZHIKODE
 District :- KOZHIKODE
 State :- KERALA
 Plot area :- 08.1765 Ha.

MUKESH SURIYA,
 M.Sc. Geology,
 Recognition as Qualified Person (RQP),
 (RQP No. -DMG/KERALA/RQP/24/2020)
 Accredited Functional Area Expert (FAE),
 Hydrology & Ground Water (HG) and
 Geology (GEO) from National Accreditation
 Board for Education and Training (NABET),
 Quality Council of India (QCI)



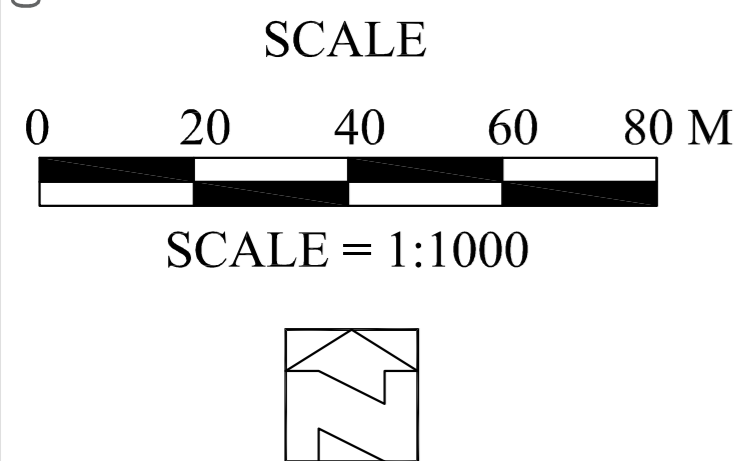
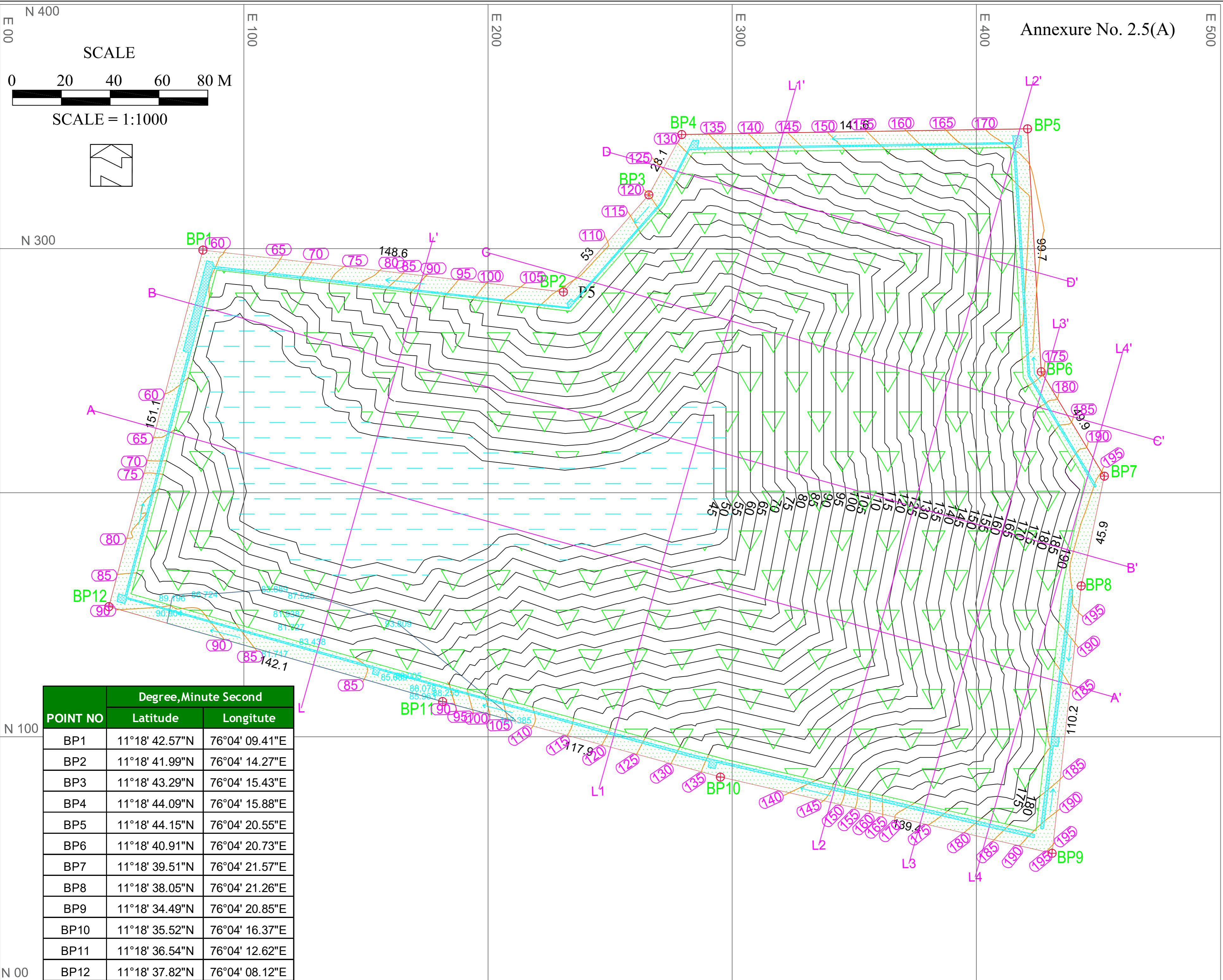
INDEX

-  LEASE BOUNDARY WITH FENCING
-  WATER POND
-  GRANITE ROCK
-  CONTOUR LINE
-  SECTION LINE
-  MINE SAFETY BARRIER LINE
-  GREEN BELT
-  RECLAIMED AREA
-  BOUNDARY PILLAR
-  PLANTATION
-  WORKING BENCH
-  RAIN WATER WAY

Project Name :- M/s. MUKKAM PROPERTY DEVELOPERS PVT. LTD.
 Village :- KUMARANELLOR
 Taluk :- KOZHIKODE
 District :- KOZHIKODE
 State :- KERALA
 Plot area :- 08.1765 Ha.

MUKESH SURIYA,
 M.Sc. Geology,
 Recognition as Qualified Person (RQP),
 (RQP No. -DMG/KERALA/RQP/24/2020)
 Accredited Functional Area Expert (FAE),
 Hydrology & Ground Water (HG) and
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 Quality Council of India (QCI)

Annexure No. 2.5(A)



POINT NO	Degree, Minute Second	
	Latitude	Longitude
BP1	11°18' 42.57"N	76°04' 09.41"E
BP2	11°18' 41.99"N	76°04' 14.27"E
BP3	11°18' 43.29"N	76°04' 15.43"E
BP4	11°18' 44.09"N	76°04' 15.88"E
BP5	11°18' 44.15"N	76°04' 20.55"E
BP6	11°18' 40.91"N	76°04' 20.73"E
BP7	11°18' 39.51"N	76°04' 21.57"E
BP8	11°18' 38.05"N	76°04' 21.26"E
BP9	11°18' 34.49"N	76°04' 20.85"E
BP10	11°18' 35.52"N	76°04' 16.37"E
BP11	11°18' 36.54"N	76°04' 12.62"E
BP12	11°18' 37.82"N	76°04' 08.12"E

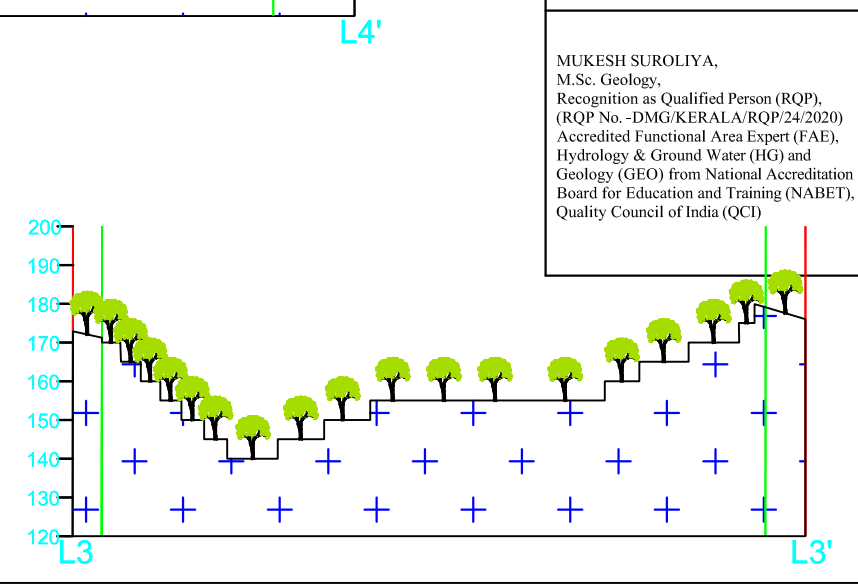
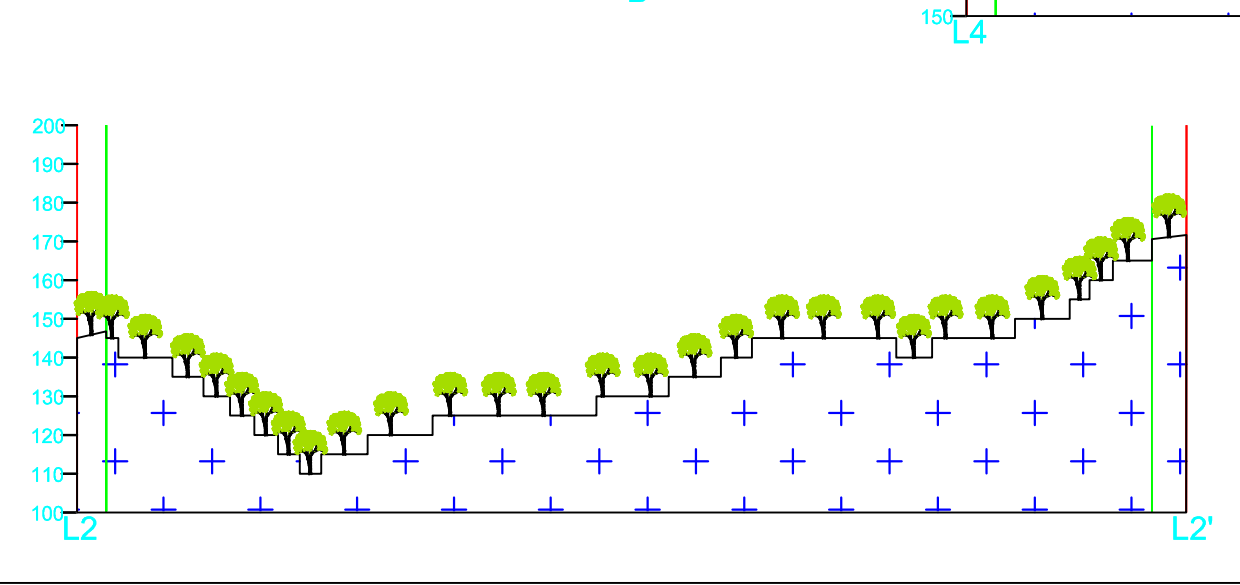
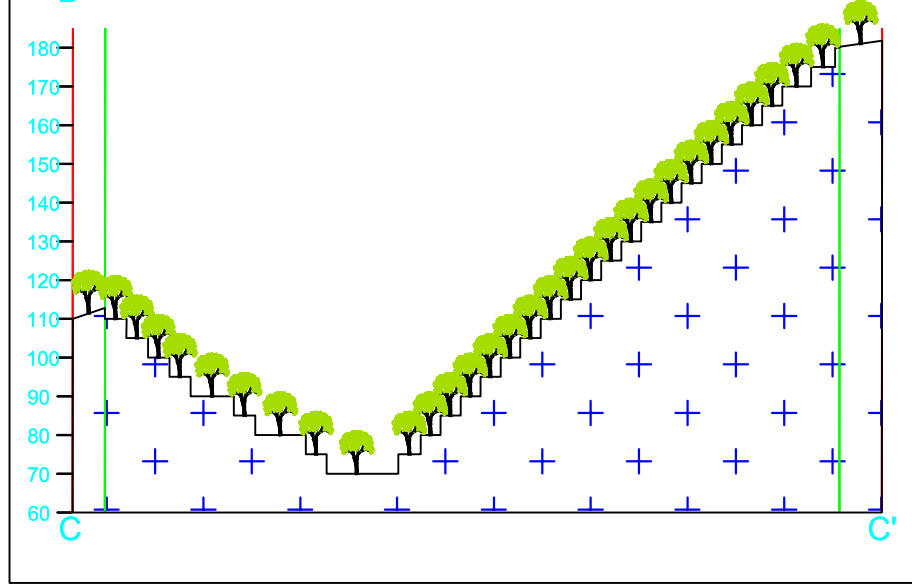
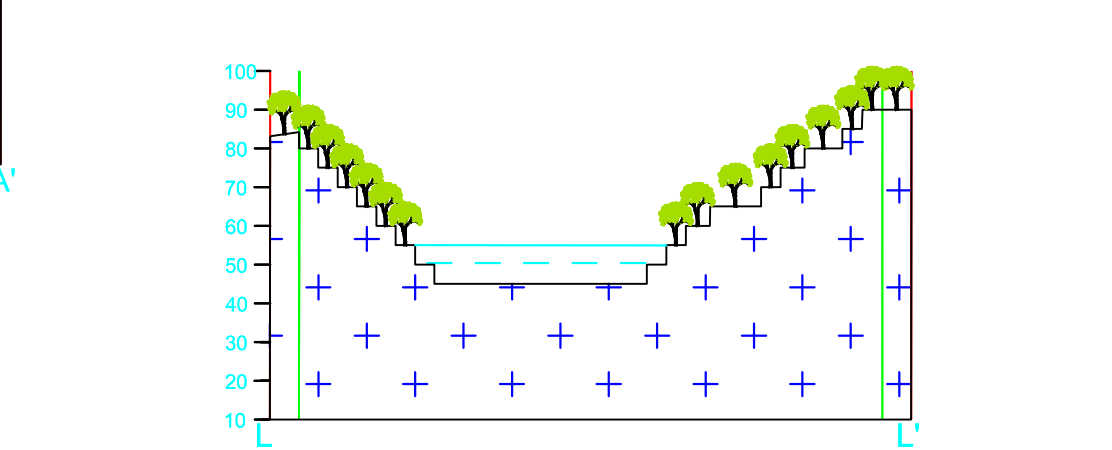
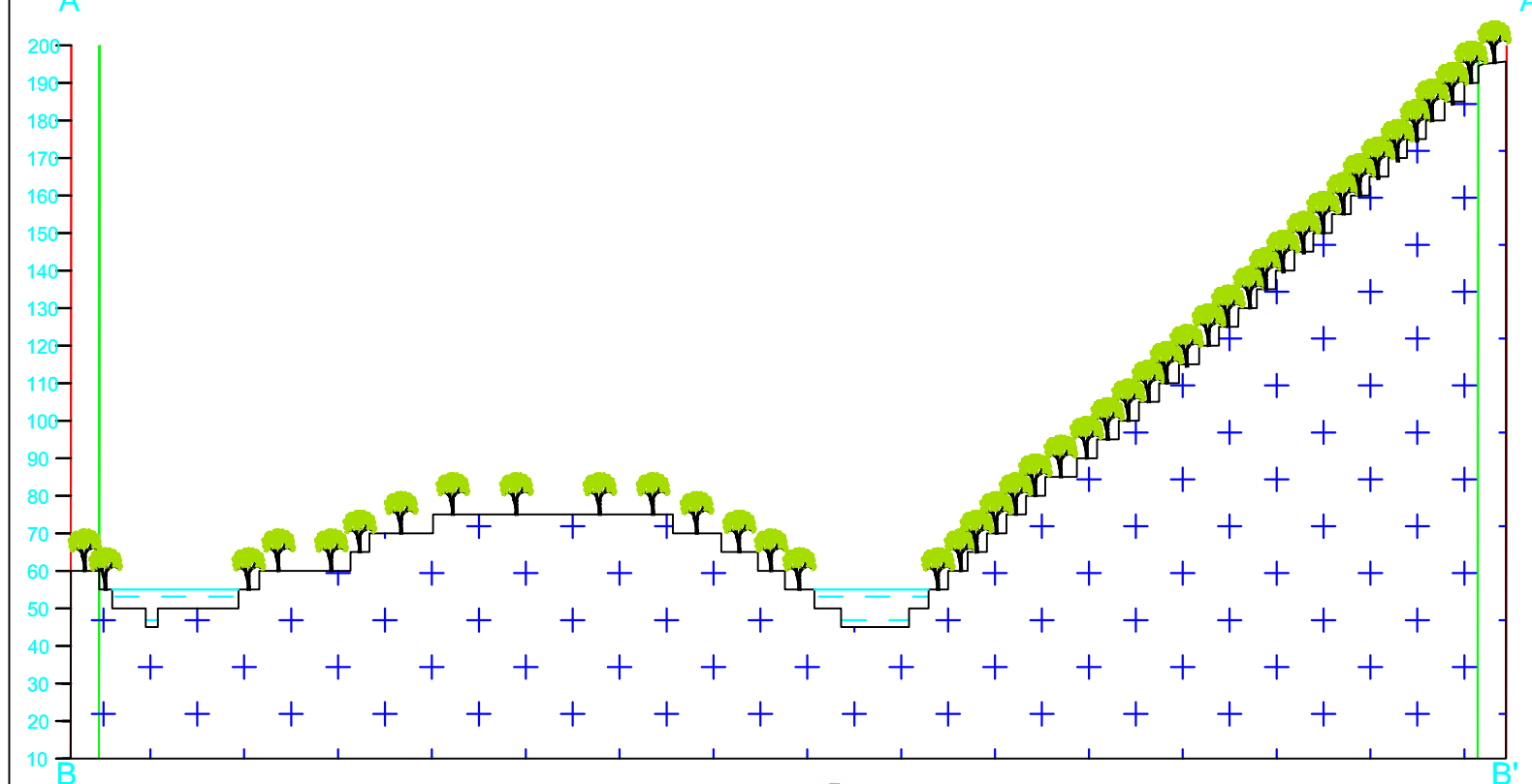
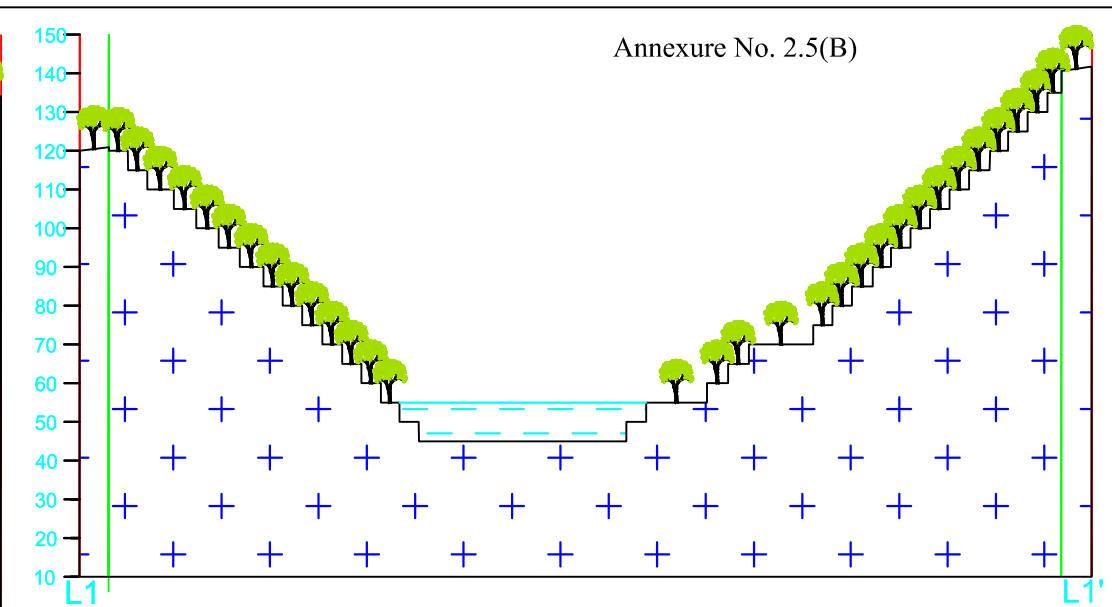
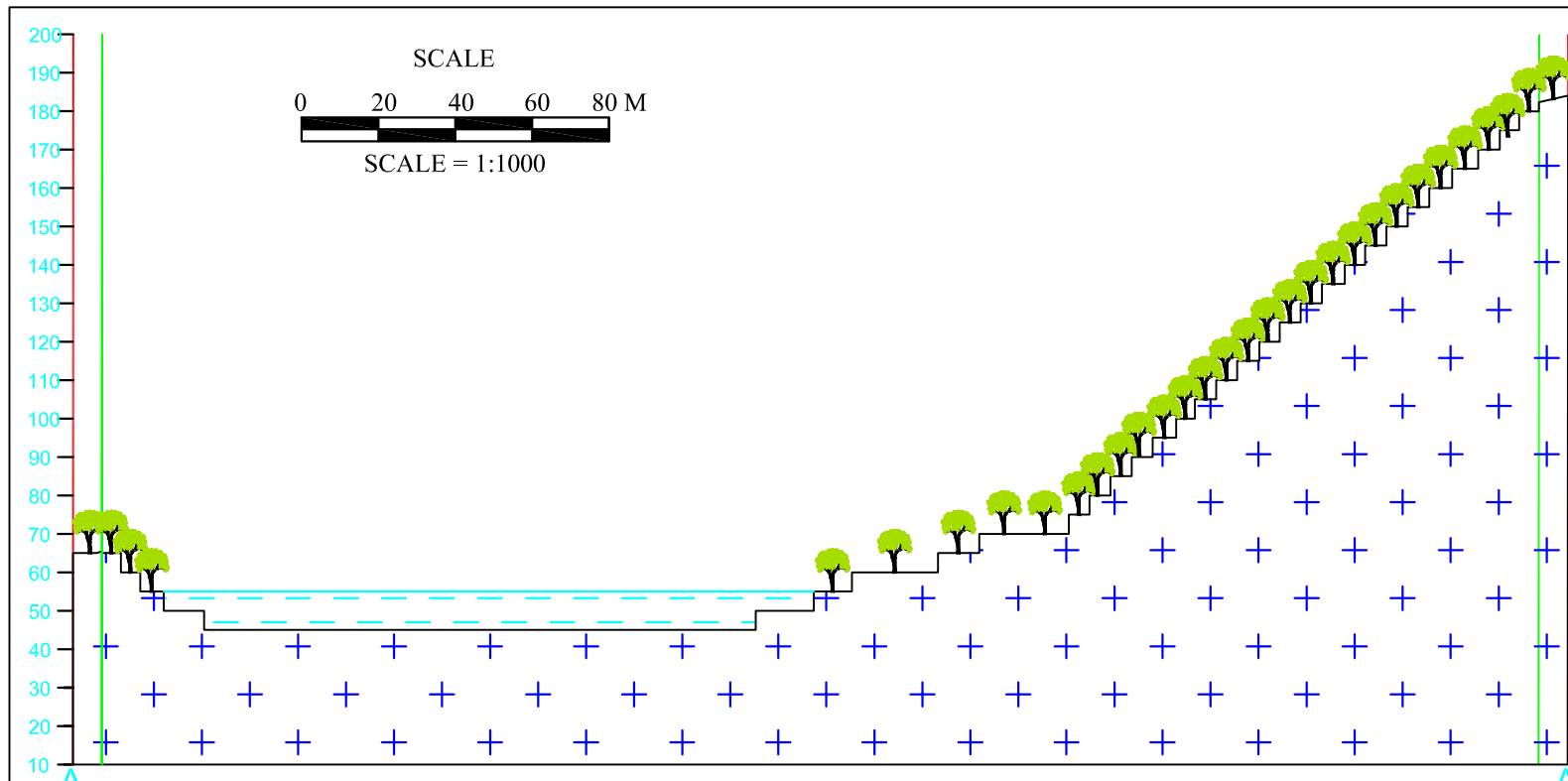


PLATE No. 8A

CONCEPTUAL PLAN (PMCP) SECTION

N

INDEX

- LEASE BOUNDARY WITH FENCING
- WATER POND
- GRANITE ROCK
- CONTOUR LINE
- SECTION LINE
- MINE SAFETY BARRIER LINE
- PLANTATION
- WORKING BENCH

Project Name :- M/s. MUKKAM PROPERTY DEVELOPERS PVT. LTD.

Village :- KUMARANELLOR

Taluk :- KOZHIKODE

District :- KOZHIKODE

State :- KERALA

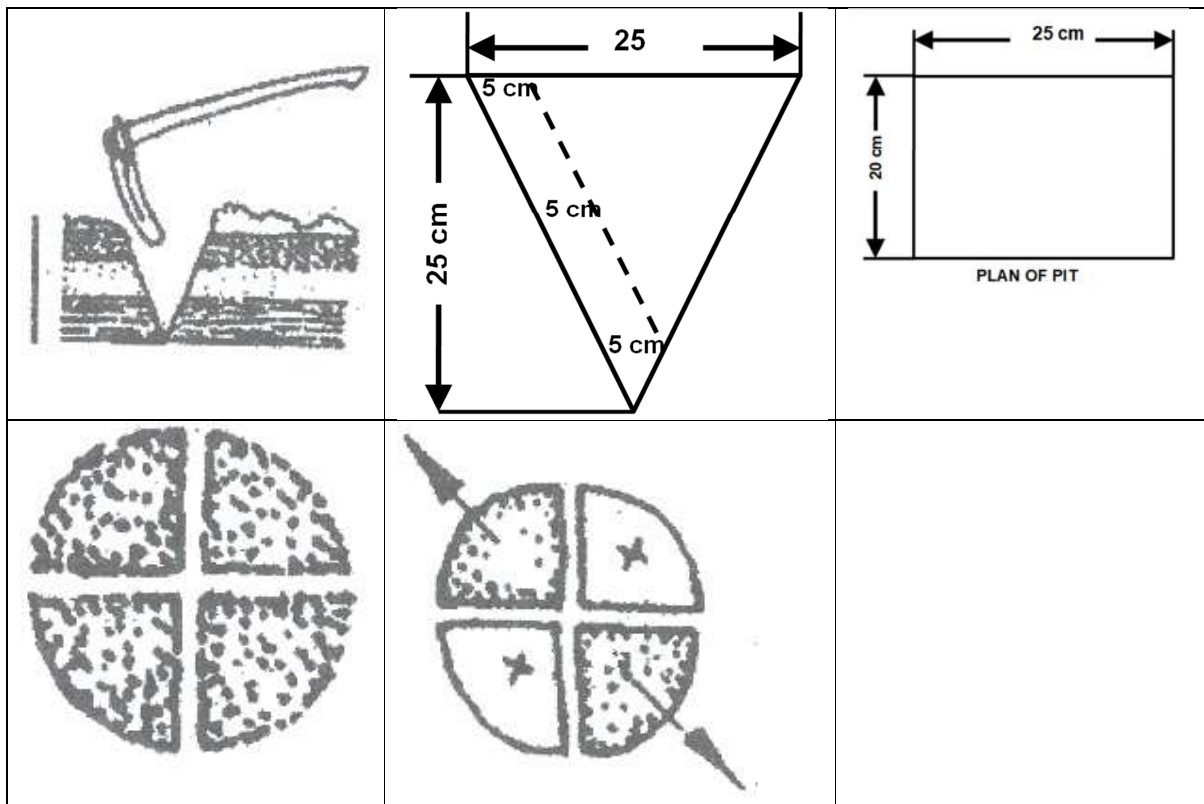
Plot area :- 08.1765 Ha.

MUKESH SUROLIYA,
M.Sc. Geology,
Recognition as Qualified Person (RQP),
(RQP No. -DMG/KERALA/RQP/24/2020)
Accredited Functional Area Expert (FAE),
Hydrology & Ground Water (HG) and
Geology (GEO) from National Accreditation
Board for Education and Training (NABET),
Quality Council of India (QCI)

Protocols for Soil sampling methodology

Soil Sampling

The protocol issued by Soil Testing Laboratory, Agricultural Department, Govt. of Kerala regarding the collection, preparation & transportation of soil samples is followed. The protocol followed is given below :-



How to collect Soil samples

The sample taken for testing should be representative of the entire area of Compensatory Afforestation (eg: 10 pits for 1 acre of land (@ 10 cents per pit). Separate samples need to be taken from each location based on soil composition, depth gradient, drainage facilities, plant growth etc. in each area.

The area where soil samples will be taken should be cleaned first by removing grass and dry leaves. From the cleaned area, using spade Cut the soil in a "V" shape (Picture of V-shaped digging is given above). Places of Compensatory Afforestation / Plantation area should be dug to a depth of 25 cm. The soil should be cut 5 cm thick from the top to the bottom of the cut pit. The soil thus obtained can be collected on a clean paper or cloth.

Mix the collected soil thoroughly and remove stones, plant debris, etc. from it. After laying the soil, line should be drawn vertically and horizontally and divided into four parts (Illustration of making 4 parts is given above).

From this, remove the two parts that come at an angle and then mix the remaining two parts again. From this again remove half the soil as above. This process should be continued until the soil is half a kilogram. The sample thus prepared should be spread on a clean floor or paper and dried in the shade. The dry soil sample can be filled in a cloth bag or a plastic bag and sent for testing. A code number should be attached to the soil sample so that it does not disappear quickly. This code number should also be recorded on the form sent along with the soil sample.

Newly fertilized areas, old ditches, waterlogged areas, and manured areas should be avoided when taking soil samples. Do not take samples from plots that have not been fertilized and limed for at least three months. The collected soil should be dried in the shade and dehumidified. Soil should not be sent for testing after 6 months of collection. Along with the soil sample, the necessary information should be recorded and sent in the form received from Krishi Bhavan.

The relevant cover page of District Soil Testing Laboratory, Ernakulam, Agriculture Department, Govt. of Kerala is given below :



TEST REPORT

ULR No:TC1219123000000367F

LRI No.:SEAAL23090901A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request dt : 07-09-2023

SAMPLE DETAILS

Product Category	Pollution & Environment	Sample Code	EN23090200
Sample Name	Soil	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	500g in Plastic Bag	Test Completed on	14-09-2023
Sampled by	Lab Authorized Sampler	Information Provided by Customer	---
Latitude	11°18'36.54"N	Longitude	76°04'23.18"E

DETAILS OF SAMPLING

Sample Source	Outside ML Area	Date of Sampling	16-09-2023
Sampling Procedure	SEAAL/CHL/SOP/7.3/01	Sample Temperature	31 °C

SAMPLING SITE DETAILS


Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT
1	pH	IS 10158: 1982	---	4.74
2	Conductivity	IS 14767: 2000	µS/cm	20.0
3	Water Holding Capacity	SEAAL/ENS/SLS/SOP/01	%	55.0
4	Organic Matter	IS 2720 (Part 22):1992	%	0.30
5	Porosity	SEAAL/ENS/SLS/SOP/02	%	36
6	Soil Texture (Type)	SEAAL/EN/SLS/SOP/14	---	Sandy- Clay
7	Total Nitrogen as N	IS 14684:1999	%	0.35
8	Potassium as K	USEPA 7000b:2007	mg/kg	360
9	Total Phosphorous as P	IS 10158: 1982	mg/kg	81.0

Remarks:




Laju P N
Laboratory Head
Authorized Signatory


Checked by:

The results are related only to the samples submitted for analysis and this test report shall not be reproduced except in full, without the written approval of the laboratory.

Standards Environmental & Analytical Laboratories

Accreditation & Approval: NABL accredited Testing Laboratory as per ISO/IEC 17025:2017
vide Certificate No. TC - 12191 & "A" Grade Laboratory approved by KSPCB.

'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110
Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

LRI No.:SEAAL23090901N	Date: 15-09-2023	Page 1 of 1
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CUSTOMER DETAILS	
Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request dt : 07-09-2023

SAMPLE DETAILS			
Product Category	Pollution & Environment	Sample Code	EN23090200
Sample Name	Soil	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	500g in Plastic Bag	Test Completed on	14-09-2023
Sampled by	Lab Authorized Sampler	Information Provided by Customer	---
Latitude	11°18'36.54"N	Longitude	76°04'23.18"E

DETAILS OF SAMPLING			
Sample Source	Outside ML Area	Date of Sampling	16-09-2023
Sampling Procedure	SEAAL/CHL/SOP/7.3/01	Sample Temperature	31 °C

SAMPLING SITE DETAILS			
Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE				
Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT
1	Permeability	SEAAL/EN/SLS/SOP/18	mm/s	0.003

Remarks:

End of Report

Checked by: 




Laiju P N
Laboratory Head
Authorized Signatory

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Standards Environmental & Analytical Laboratories

Approval: "A" Grade Laboratory approved by Kerala State Pollution Control Board.

'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110
Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No:TC1219123000000368F		
LRI No.:SEAAL23090902A	Date: 15-09-2023	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request dt :07-09-2023

SAMPLE DETAILS			
Product Category	Pollution & Environment	Sample Code	EN23090201
Sample Name	Soil	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	500g in Plastic Bag	Test Completed on	14-09-2023
Sampled by	Lab Authorized Sampler	Information Provided by Customer	---
Latitude	11°18'40.46"N	Longitude	76°04'10.42"E

DETAILS OF SAMPLING			
Sample Source	Project site (within the mine boundary Area)	Date of Sampling	16-09-2023
Sampling Procedure	SEAAL/CHL/SOP/7.3/01	Sample Temperature	31 °C

SAMPLING SITE DETAILS			
Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala


TEST RESULTS- CHEMICAL DISCIPLINE				
Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT
1	pH	IS 10158: 1982	---	4.87
2	Conductivity	IS 14767: 2000	μS/cm	24.0
3	Water Holding Capacity	SEAAL/ENS/SLS/SOP/01	%	58.0
4	Organic Matter	IS 2720 (Part 22):1992	%	0.32
5	Porosity	SEAAL/ENS/SLS/SOP/02	%	36
6	Soil Texture (Type)	SEAAL/EN/SLS/SOP/14	---	Sandy- Clay
7	Total Nitrogen as N	IS 14684:1999	%	0.32
8	Potassium as K	USEPA 7000b:2007	mg/kg	378
9	Total Phosphorous as P	IS 10158: 1982	mg/kg	83.0

Remarks:

Checked by: 

End of Report




Laju P N
Laboratory Head
Authorized Signatory

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Accreditation & Approval: NABL accredited Testing Laboratory as per ISO/IEC 17025:2017

vide Certificate No. TC - 12191 & "A" Grade Laboratory approved by KSPCB.

'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110

Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: sealab@gmail.com

TEST REPORT

LRI No.:SEAAL23090902N	Date: 15-09-2023	Page 1 of 1
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CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request dt : 07-09-2023

SAMPLE DETAILS

Product Category	Pollution & Environment	Sample Code	EN23090201
Sample Name	Soil	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	500g in Plastic Bag	Test Completed on	14-09-2023
Sampled by	Lab Authorized Sampler	Information Provided by Customer	---
Latitude	11°18'40.46"N	Longitude	76°04'10.42"E

DETAILS OF SAMPLING

Sample Source	Project site (within the mine boundary Area)	Date of Sampling	16-09-2023
Sampling Procedure	SEAAL/CHL/SOP/7.3/01	Sample Temperature	31 °C

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE


Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT
1	Permeability	SEAAL/EN/SLS/SOP/18	mm/s	0.003

Remarks:

End of Report

Checked by: 




Laiju P N
Laboratory Head
Authorized Signatory

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Standards Environmental & Analytical Laboratories

Approval: "A" Grade Laboratory approved by Kerala State Pollution Control Board.

'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110
Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: sealab@gmail.com



TEST REPORT

ULR No:TC121912300000370F

LRI No.:SEAAL23090904A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranelloor, Kozhikode District.
Customer Reference	Test Request dt : 07-09-2023

SAMPLE DETAILS

Product Category	Pollution & Environment	Sample Code	EN23090203
Sample Name	Soil	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	500g in Plastic Bag	Test Completed on	14-09-2023
Sampled by	Lab Authorized Sampler	Information Provided by Customer	---
Latitude	11°18'42.51"N	Longitude	76°04'06.70"E

DETAILS OF SAMPLING

Sample Source	Outside ML Boundary (80 m. from the mine boundary)	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/CHL/SOP/7.3/01	Sample Temperature	31 °C

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranelloor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT
1	pH	IS 10158: 1982	---	4.79
2	Conductivity	IS 14767: 2000	µS/cm	28.0
3	Water Holding Capacity	SEAAL/ENS/SLS/SOP/01	%	52.0
4	Organic Matter	IS 2720 (Part 22):1992	%	0.35
5	Porosity	SEAAL/ENS/SLS/SOP/02	%	24.0
6	Soil Texture (Type)	SEAAL/EN/SLS/SOP/14	---	Sandy- Soil
7	Total Nitrogen as N	IS 14684:1999	%	0.30
8	Potassium as K	USEPA 7000b:2007	mg/kg	300
9	Total Phosphorous as P	IS 10158: 1982	mg/kg	54.3

Remarks:

Checked by:

End of Report



Laiju P N
Laboratory Head
Authorized Signatory

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Standards Environmental & Analytical Laboratories

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vide Certificate No. TC - 12191 & "A" Grade Laboratory approved by KSPCB.

'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110
Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

LRI No.:SEAL23090904N	Date: 15-09-2023	Page 1 of 1
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CUSTOMER DETAILS	
Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request dt : 07-09-2023

SAMPLE DETAILS			
Product Category	Pollution & Environment	Sample Code	EN23090203
Sample Name	Soil	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	500g in Plastic Bag	Test Completed on	14-09-2023
Sampled by	Lab Authorized Sampler	Information Provided by Customer	---
Latitude	11°18'42.51"N	Longitude	76°04'06.70"E

DETAILS OF SAMPLING			
Sample Source	Outside ML Boundary (80 m. from the mine boundary)	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/CHL/SOP/7.3/01	Sample Temperature	31 °C

SAMPLING SITE DETAILS			
Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE				
Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT
1	Permeability	SEAAL/EN/SLS/SOP/18	mm/s	0.004

Remarks:

End of Report

Checked by: 




Laiju P N
Laboratory Head
Authorized Signatory

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Standards Environmental & Analytical Laboratories

Approval: "A" Grade Laboratory approved by Kerala State Pollution Control Board.

'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110
Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com



TEST REPORT

ULR No:TC121912300000369F

LRI No.:SEAAL23090903A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request dt : 07-09-2023

SAMPLE DETAILS

Product Category	Pollution & Environment	Sample Code	EN23090202
Sample Name	Soil	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	500g in Plastic Bag	Test Completed on	14-09-2023
Sampled by	Lab Authorized Sampler	Information Provided by Customer	---
Latitude	11°18'43.25"N	Longitude	76°03'54.39"E

DETAILS OF SAMPLING

Sample Source	Outside ML Boundary (450 m. from the mine boundary)	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/CHL/SOP/7.3/01	Sample Temperature	31 °C

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE


Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT
1	pH	IS 10158: 1982	---	4.85
2	Conductivity	IS 14767: 2000	μS/cm	30.0
3	Water Holding Capacity	SEAAL/ENS/SLS/SOP/01	%	55.0
4	Organic Matter	IS 2720 (Part 22):1992	%	0.33
5	Porosity	SEAAL/ENS/SLS/SOP/02	%	35.0
6	Soil Texture (Type)	SEAAL/EN/SLS/SOP/14	---	Sandy- Clay Loam
7	Total Nitrogen as N	IS 14684:1999	%	0.33
8	Potassium as K	USEPA 7000b:2007	mg/kg	380
9	Total Phosphorous as P	IS 10158: 1982	mg/kg	45.9

Remarks:

Checked by: 

End of Report




Laiju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

LRI No.:SEAAL23090903N	Date: 15-09-2023	Page 1 of 1
------------------------	------------------	-------------

CUSTOMER DETAILS	
Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request dt : 07-09-2023

SAMPLE DETAILS			
Product Category	Pollution & Environment	Sample Code	EN23090202
Sample Name	Soil	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	500g in Plastic Bag	Test Completed on	14-09-2023
Sampled by	Lab Authorized Sampler	Information Provided by Customer	---
Latitude	11°18'43.25"N	Longitude	76°03'54.39"E

DETAILS OF SAMPLING			
Sample Source	Outside ML Boundary (450 m. from the mine boundary)	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/CHL/SOP/7.3/01	Sample Temperature	31 °C

SAMPLING SITE DETAILS			
Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala


TEST RESULTS- CHEMICAL DISCIPLINE				
Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT
1	Permeability	SEAAL/EN/SLS/SOP/18	mm/s	0.003

Remarks:

End of Report

Checked by: 




Laiju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com



സംസ്ഥാന കൃഷി വകുപ്പ്, കേരള സർക്കാർ
ജില്ലാ മണ്ണ് പരിശോധനാശാല, എറണാകുളം
മണ്ണ് പരിശോധനാ റിപ്പോർട്ട്

Annexure No. 3.2(E)

കർഷകന്റെ പേര്	C.K.Abdul Azeez	കൃഷി ഭവൻ	0
സർവ്വേ നമ്പർ	0	ലാബ് നമ്പർ	76
മണ്ണ് പരിശോധനയുടെ ഫലം		സാമ്പിൾ കോഡ്	0

പരിശോധനാ ഘടകം	പി എച്ച് മൂല്യം	ലവണ മൂല്യം (TSS)	ലഭ്യമായ						ബോറോൺ	ഇരുമ്പ്	മംഗനീസ്	സിങ്ക്	കോപർ
			ജൈവ കാർബൺ	ഫോസ്ഫറസ്	പൊട്ടാസ്യം	കാൽഷ്യം	മഗ്നീഷ്യം	സൾഫർ					
അളവ്			%	Kg/ha	Kg/ha	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
ഫലം	6.30	0.075	1.49	11	179	0.0	0.0	5.4	0.4	59.1	16.7	15.2	5.4
നിലവാരം	അമൃത	ക്രമം	കുറുതൽ	മദ്ധ്യമം	മദ്ധ്യമം			പര്യാപ്തം	അപര്യാപ്തം	പര്യാപ്തം	പര്യാപ്തം	പര്യാപ്തം	പര്യാപ്തം
ക്ലാസ്	5	-	6	3	4								

ശുപാർശ (for acidic soil) സൂക്ഷ്മ മൂലകങ്ങളുടെ അപര്യാപ്ത പരിഹരിക്കുന്നതിന് ചേർക്കേണ്ടവ (ഒരു ഹെക്ടറിന്) 0.5% Borax Soln as foliar spray or 10 Kg Borax

വളപ്രയോഗ ശുപാർശ (പോഷകമൂലകങ്ങളുടെ അളവിൽ)

വിള	നൈട്രജൻ	ഫോസ്ഫറസ് (P ₂ O ₅)	പൊട്ടാസ്യം (K ₂ O ₂)
മാവ് 10 + വർഷം	390 ഗ്രാം	338 ഗ്രാം	623 ഗ്രാം

സാമ്പിൾ പരിശോധിച്ച തീയതി: 08-09-2023
 ഇവിടെ മടക്കുക
 മണ്ണിന്റെ ഇനം
 ചെമ്മണ്ണ്/പശിമയുള്ള മണ്ണ്

വളപ്രയോഗ ശുപാർശ (തേർവളങ്ങളുടെ അളവിൽ)

വിള	തൂറിയാ	റോക് ഫോസ്ഫേറ്റ്	മ്യൂറേറ്റ് ഫോസ്ഫേറ്റ്	മഗ്നീഷ്യം സൾഫേറ്റ്	ചിരം	കുത്തായം	ജൈവ വളം	അളവ്
മാവ് 10 + വർഷം	848 ഗ്രാം	1690 ഗ്രാം	1038 ഗ്രാം			400 ഗ്രാം	75 (ഓ./മം)**	മരത്തിന്

koshykunju@gmail.com / 9847 222 730

** ജൈവവളത്തിനു മാത്രമുള്ള പ്രത്യേക അളവ്

സ്ഥലം : നെട്ടൂർ പി ഒ, എറണാകുളം
 തീയതി : 13-09-2023

അസിസ്റ്റന്റ് സോയിൽ പരിശോധകൻ
 District Soil Testing Laboratory
 Ernakulam, Vyttila - 682 040



ON I. G. S.
Book Post



സീകർത്താവ്

C.K.Abdul Azeez
 Cheenathamkuzhiyil
 Mukkam, Malayamma.P.O.
 9633730330

പ്രേഷിതൻ
 അസിസ്റ്റന്റ് സോയിൽ കെമിസ്ട്രി
 ജില്ലാ മണ്ണ് പരിശോധനാശാല,
 നെട്ടൂർ പി ഒ, മരട് മാർക്കറ്റ്, എറണാകുളം

No: 940/18

സാക്ഷ്യപത്രം

താഴെ പട്ടികയിൽ വിവരിച്ചിട്ടുള്ള 8.8951 ഹെക്ടർ ഭൂമി റവന്യൂ വകുപ്പ് മറ്റു പ്രത്യേക ആവശ്യങ്ങൾക്ക് പതിച്ചുകൊടുത്തതല്ലെന്നും റിസർവ്വ് വനത്തിൽ ഉൾപ്പെടുന്നതല്ലെന്നും ടി വകകളിൽ മേൽ കോടതി/ബാങ്ക് അറ്റാച്ച്മെന്റ് ഇല്ലായെന്നും ടി ഭൂമി ആദിവാസി വിഭാഗങ്ങൾക്ക് അവകാശപ്പെട്ടതല്ലെന്നും ടി ഭൂമിയുടെ 500 മീറ്റർ പരിധിയിൽ/സമീപത്തേക്കും ആദിവാസി സെറ്റിൽമെന്റുകൾ ഇല്ലായെന്നും സാക്ഷ്യപ്പെടുത്തുന്നു.

NO	SURVEY NO	VILLAGE	THALUK	SRO	OWNERSHIP DETAILS	DOCUMENT NO	TOTAL AREA IN POSESSION (ha)
1	UNSURVEY	KUMARANELLUR	KOZHICODE	KOZHICODE	MANAGING DIRECTOR M/S MUKKAM PROPERTY DEVELEPORS PVT LTD	272/1/2017	1.8137
2	UNSURVEY	KUMARANELLUR	KOZHICODE	KOZHICODE	MANAGING DIRECTOR M/S MUKKAM PROPERTY DEVELEPORS PVT LTD	270/1/2017	1.2253
3	UNSURVEY	KUMARANELLUR	KOZHICODE	KOZHICODE	MANAGING DIRECTOR M/S MUKKAM PROPERTY DEVELEPORS PVT LTD	271/1/2017	1.8137
4	UNSURVEY	KUMARANELLUR	KOZHICODE	KOZHICODE	MANAGING DIRECTOR M/S MUKKAM PROPERTY DEVELEPORS PVT LTD	269/1/2017	0.4151
							5.2678
NO	SURVEY NO	VILLAGE	THALUK	SRO	OWNERSHIP DETAILS	DOCUMENT NO	TOTAL AREA IN POSESSION (ha)
1	UNSURVEY	KUMARANELLUR	KOZHICODE	MUKKAM	CK ABDUL AZEEZ S/O AHAMMED	3105/1/2015	1.2091
2	UNSURVEY	KUMARANELLUR	KOZHICODE	MUKKAM	CK ABDUL AZEEZ S/O AHAMMED	3115/1/2015	1.2091
3	UNSURVEY	KUMARANELLUR	KOZHICODE	MUKKAM	CK ABDUL AZEEZ S/O AHAMMED	3114/1/2015	1.2091

3.6273

ഈ സാക്ഷ്യപത്രം കരിങ്കല്ല് ഖനന ആവശ്യാർത്ഥം മൈനിംഗ് & ജിയോളജി വകുപ്പിൽ ഹാജരാക്കുന്നതിനുവേണ്ടിയാണ് അനുവദിക്കുന്നത്.



Muhammed
02/11/18
VILLAGE OFFICER
KUMARANELLUR

വില്ലേജ് ഓഫീസർ

Sampling methodology and protocols for Water sampling

Sampling Methodology:

- Sampling of water was done as per CPCB/NABL guidelines.
- CPCB guidelines followed for location identification

The guidelines / protocols followed in the water sample collection, preservation & transportation is discussed below :-

Surface Water Sampling

- Ensuring the water samples collected from well-mixed section of the water body 30 cm. below the water surface using a water sampler. (Niskin type).
- DO is determined in a sample collected in a DO bottle. The DO in the sample was fixed immediately after collection, fixing chemical reagents. DO concentration was then determined in the laboratory.

Ground Water Sampling

- Samples for groundwater quality monitoring was collected from the following types of well:
- *Open dug well*
- Open dug well, which is in use in the site considered as water quality monitoring station.
- The weighted sample bottle was used to collect sample from an open well about 30 cm below the surface of the water.
- For bacteriological samples, when collected from tube-wells/hand pump, the spout/outlet of the pump was sterilized under flame by spirit lamp before collection of sample in container.

Sample Labelling Guidelines:-

The label of the sample container was properly, preferably attached with a water-proof label. Information on the sample container includes:

- Sample code number (identifying location)
- Date and time of sampling
- Source and type of sample
- Pre-treatment or preservation carried out on the sample
- Any special notes for the analyst
- Sampler's name

Sample Preservation and Transport

- The samples collected for BOD and bacteriological analyses should be stored at a temperature below 4°C and in the dark as soon as possible after sampling. In the field, this usually means placing them in an insulated cool box together with ice or cold packs.
- Once the samples were collected and brought to the laboratory, samples were transferred to a refrigerator. Samples collected for chemical oxygen demand (COD) analysis were analyzed on the day of collection, after preserving below pH₂ by addition of concentrated sulphuric acid.
- The samples which were to be analyzed for the presence of metals, were acidified to below pH₂ with concentrated nitric acid.
- The samples were transported to concerned laboratory as soon as possible, preferably within 48 hours.
- The analysis of bacteriological samples were analyzed within 24 hours of collection.



TEST REPORT

ULR No: TC1219123000000371F

LRI No.:SEAAL23090905A

Date: 15-09-2023

Page 1 of 2

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request Date: 07-09-2023

SAMPLE DETAILS

Product Category	Water	Sample Code	WT23090186
Sample Name	Ground Water	Sample Received on	08-09-2023
Sample Description by Customer	Open Well Water-1	Temperature @ Receipt	4°C
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	2 L & 125 ml in a Plastic Bottle	Test Completed on	14-09-2023
Information Provided by Customer	---	Sampled by	Lab Authorized Sampler
Latitude	11°18'44.09"N	Longitude	76° 3'46.16"E

DETAILS OF SAMPLING

Sample Source	Owned by Mr. Abdul Azeez, near Jalanidhi MDWS, Maranchatti	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/QAD/SOP/7.3/01	Sample Temperature	26°C

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
1	Turbidity	IS 3025 (Part 10):1984	NTU	0.3	1 (Max)
2	pH	IS 3025 (Part 11):1983	---	5.86	6.50-8.50
3	Total Dissolved Solids	IS 3025 (Part 16): 1984	mg/L	25.4	500 (Max)
4	Total Alkalinity as CaCO ₃	IS 3025 (Part 23):1986	mg/L	7.92	200(Max)
5	Total Hardness as CaCO ₃	IS 3025 (Part 21):2009	mg/L	6.00	200(Max)

Checked by:



Remya B
Remya B
TM-Biological
Authorized Signatory

Laiju P N
Laiju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No: TC1219123000000371F

LRI No.:SEAAL23090905A

Date: 15-09-2023

Page 2 of 2

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
5	Total Hardness as CaCO ₃	IS 3025 (Part 21):2009	mg/L	6.00	200(Max)
6	Chloride as Cl	IS 3025 (Part 32):1988	mg/L	4.03	250(Max)
7	Sulphate as SO ₄	IS 3025 (Part 24):1986	mg/L	2.58	200 (Max)
8	Nitrate as NO ₃	APHA 23 rd Edition 4500-NO3 B 2017	mg/L	<1.00	45(Max)
9	Fluoride as F	IS 3025 (Part 60): 2008	mg/L	<0.10	1.0(Max)
10	Magnesium as Mg	IS 3025 (Part 46): 1994	mg/L	<1.00	30 (Max)
11	Iron as Fe	IS 3025 (Part 53):2003	mg/L	0.39	1.00 (Max)
12	Ammonia as total ammonia -N	IS 3025 (Part 34):1988	mg/L	<0.01	0.5 (Max)
13	Lead as Pb	IS 3025 (Part 47): 1994	mg/L	BDL (LOD-0.01)	0.01 (Max)
14	Copper as Cu	IS 3025 (Part 42): 1992	mg/L	BDL (LOD-0.016)	0.05 (Max)
15	Cadmium as Cd	IS 3025 (Part 41): 1992	mg/L	BDL (LOD-0.003)	0.003 (Max)
16	Mercury as Hg	IS 3025 (Part 48): 1994	mg/L	BDL (LOD-0.001)	0.001 (Max)
17	Zinc as Zn	APHA 23 rd Edition 3111B:2017	mg/L	BDL (LOD-0.008)	5.00 (Max)
18	Arsenic as As	APHA 23 rd Edition 3114C:2017	mg/L	BDL (LOD-0.001)	0.01 (Max)
19	Chromium as Cr	IS 3025 (Part 52): 2003	mg/L	BDL (LOD-0.05)	0.05 (Max)
20	Nickel as Ni	IS 3025 (Part 54): 2003	mg/L	BDL(LOD-0.02)	0.02 (Max)
21	Dissolved Oxygen	IS 3025 (Part 38): 1989	mg/L	6.90	---
22	Biochemical Oxygen Demand(3 days at 27 °C)	IS 3025 (Part 44): 1993	mg/L	<2.00	---
23	Chemical Oxygen Demand	IS 3025 Part 58: 2006	mg/L	<4.00	---

TEST RESULTS - BIOLOGICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
1	Total Coliform Bacteria	IS 15185: 2016	----	Present/100 ml	Absent/100 ml
2	E coli	IS 15185: 2016	----	Absent/100 ml	Absent/100 ml

Remarks:

End of Report

Checked by:



Remiya B
TM-Biological
Authorized Signatory

Laiju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No: TC1219123000000372F

LRI No.:SEAAL23090906A

Date: 15-09-2023

Page 1 of 2

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request Date: 07-09-2023

SAMPLE DETAILS

Product Category	Water	Sample Code	WT23090187
Sample Name	Ground Water	Sample Received on	08-09-2023
Sample Description by Customer	Open Well Water-2	Temperature @ Receipt	4°C
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	2 L & 125 ml in a Plastic Bottle	Test Completed on	14-09-2023
Information Provided by Customer	---	Sampled by	Lab Authorized Sampler
Latitude	11°18'41.18"N	Longitude	76° 3'44.66"E

DETAILS OF SAMPLING

Sample Source	Owned by Mr. Abdul Azeez, near Juma Masjid, Maranchatti	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/QAD/SOP/7.3/01	Sample Temperature	26°C

SAMPLING SITE DETAILS

Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
1	Turbidity	IS 3025 (Part 10):1984	NTU	<0.10	1 (Max)
2	pH	IS 3025 (Part 11):1983	---	5.66	6.50-8.50
3	Total Dissolved Solids	IS 3025 (Part 16): 1984	mg/L	22.4	500 (Max)
4	Total Alkalinity as CaCO ₃	IS 3025 (Part 23):1986	mg/L	3.96	200(Max)
5	Total Hardness as CaCO ₃	IS 3025 (Part 21):2009	mg/L	6.00	200(Max)

Checked by:



Remya B
Remya B
TM-Biological
Authorized Signatory

Laiju P N
Laiju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No.: TC1219123000000372F

LRI No.:SEAAL23090906A

Date: 15-09-2023

Page 2 of 2

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
6	Chloride as Cl	IS 3025 (Part 32):1988	mg/L	4.03	250(Max)
7	Sulphate as SO ₄	IS 3025 (Part 24):1986	mg/L	1.92	200 (Max)
8	Nitrate as NO ₃	APHA 23 rd Edition 4500-NO3 B 2017	mg/L	<1.00	45(Max)
9	Fluoride as F	IS 3025 (Part 60): 2008	mg/L	<0.10	1.0(Max)
10	Magnesium as Mg	IS 3025 (Part 46): 1994	mg/L	<1.00	30 (Max)
11	Iron as Fe	IS 3025 (Part 53):2003	mg/L	0.11	1.00 (Max)
12	Ammonia as total ammonia -N	IS 3025 (Part 34):1988	mg/L	<0.01	0.5 (Max)
13	Lead as Pb	IS 3025 (Part 47): 1994	mg/L	BDL (LOD-0.01)	0.01 (Max)
14	Copper as Cu	IS 3025 (Part 42): 1992	mg/L	BDL (LOD-0.016)	0.05 (Max)
15	Cadmium as Cd	IS 3025 (Part 41): 1992	mg/L	BDL (LOD-0.003)	0.003 (Max)
16	Mercury as Hg	IS 3025 (Part 48): 1994	mg/L	BDL (LOD-0.001)	0.001 (Max)
17	Zinc as Zn	APHA 23 rd Edition 3111B:2017	mg/L	BDL (LOD-0.008)	5.00 (Max)
18	Arsenic as As	APHA 23 rd Edition 3114C:2017	mg/L	BDL (LOD-0.001)	0.01 (Max)
19	Chromium as Cr	IS 3025 (Part 52): 2003	mg/L	BDL (LOD-0.05)	0.05 (Max)
20	Nickel as Ni	IS 3025 (Part 54): 2003	mg/L	BDL(LOD-0.02)	0.02 (Max)
21	Dissolved Oxygen	IS 3025 (Part 38): 1989	mg/L	6.90	---
22	Biochemical Oxygen Demand(3 days at 27 °C)	IS 3025 (Part 44): 1993	mg/L	<2.00	---
23	Chemical Oxygen Demand	IS 3025 Part 58: 2006	mg/L	<4.00	---

TEST RESULTS - BIOLOGICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
1	Total Coliform Bacteria	IS 15185: 2016	----	Present/100 ml	Absent/100 ml
2	E coli	IS 15185: 2016	----	Absent/100 ml	Absent/100 ml

Remarks:

End of Report

Checked by:



Remya B
TM-Biological
Authorized Signatory

Laju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com



TEST REPORT

ULR No: TC1219123000000373F

LRI No.:SEAAL23090907A

Date: 15-09-2023

Page 1 of 2

CUSTOMER DETAILS

Customer Name & Address **M/s Mukkom Property Developers Pvt. Ltd.**
Kumaranellor, Kozhikode District.

Customer Reference Test Request Date: 07-09-2023

SAMPLE DETAILS

Product Category	Water	Sample Code	WT23090188
Sample Name	Surface Water-1	Sample Received on	08-09-2023
Sample Description by Customer	Surface Water	Temperature @ Receipt	4°C
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	2 L & 125 ml in a Plastic Bottle	Test Completed on	14-09-2023
Information Provided by Customer	---	Sampled by	Lab Authorized Sampler
Latitude	11°18'43.23"N	Longitude	76° 3'45.53"E

DETAILS OF SAMPLING

Sample Source	Main Outlet Thodu, Near Jalanidhi, Maranchatty 697 m From ML Area in West Direction	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/QAD/SOP/7.3/01	Sample Temperature	26°C

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
1	Turbidity	IS 3025 (Part 10):1984	NTU	0.60	1 (Max)
2	pH	IS 3025 (Part 11):1983	---	5.89	6.50-8.50
3	Total Dissolved Solids	IS 3025 (Part 16): 1984	mg/L	26.0	500 (Max)

Checked by:



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TM-Biological
Authorized Signatory

Laju P N
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TEST REPORT

ULR No: TC1219123000000373F

LRI No.:SEAL23090907A

Date: 15-09-2023

Page 2 of 2

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
4	Total Alkalinity as CaCO ₃	IS 3025 (Part 23):1986	mg/L	5.94	200(Max)
5	Total Hardness as CaCO ₃	IS 3025 (Part 21):2009	mg/L	6.00	200(Max)
6	Chloride as Cl	IS 3025 (Part 32):1988	mg/L	4.03	250(Max)
7	Sulphate as SO ₄	IS 3025 (Part 24):1986	mg/L	4.44	200 (Max)
8	Nitrate as NO ₃	APHA 23 rd Edition 4500-NO3 B 2017	mg/L	<1.00	45(Max)
9	Fluoride as F	IS 3025 (Part 60): 2008	mg/L	<0.10	1.0(Max)
10	Magnesium as Mg	IS 3025 (Part 46): 1994	mg/L	<1.00	30 (Max)
11	Iron as Fe	IS 3025 (Part 53):2003	mg/L	0.85	1.00 (Max)
12	Ammonia as total ammonia -N	IS 3025 (Part 34):1988	mg/L	<0.01	0.5 (Max)
13	Lead as Pb	IS 3025 (Part 47): 1994	mg/L	BDL (LOD-0.01)	0.01 (Max)
14	Copper as Cu	IS 3025 (Part 42): 1992	mg/L	BDL (LOD-0.016)	0.05 (Max)
15	Cadmium as Cd	IS 3025 (Part 41): 1992	mg/L	BDL (LOD-0.003)	0.003 (Max)
16	Mercury as Hg	IS 3025 (Part 48): 1994	mg/L	BDL (LOD-0.001)	0.001 (Max)
17	Zinc as Zn	APHA 23 rd Edition 3111B:2017	mg/L	BDL (LOD-0.008)	5.00 (Max)
18	Arsenic as As	APHA 23 rd Edition 3114C:2017	mg/L	BDL (LOD-0.001)	0.01 (Max)
19	Chromium as Cr	IS 3025 (Part 52): 2003	mg/L	BDL (LOD-0.05)	0.05 (Max)
20	Nickel as Ni	IS 3025 (Part 54): 2003	mg/L	BDL(LOD-0.02)	0.02 (Max)
21	Dissolved Oxygen	IS 3025 (Part 38): 1989	mg/L	6.20	---
22	Biochemical Oxygen Demand(3 days at 27 °C)	IS 3025 (Part 44): 1993	mg/L	<2.00	---
23	Chemical Oxygen Demand	IS 3025 Part 58: 2006	mg/L	<4.00	---

TEST RESULTS - BIOLOGICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
1	Total Coliform Bacteria	IS 15185: 2016	----	Present/100 ml	Absent/100 ml
2	E coli	IS 15185: 2016	----	Absent/100 ml	Absent/100 ml

Remarks:

End of Report

Checked by:



Remya B
TM-Biological
Authorized Signatory

Laiju P N
Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No: TC121912300000374F

LRI No.:SEAAL23090908A

Date: 15-09-2023

Page 1 of 2

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request Date: 07-09-2023

SAMPLE DETAILS

Product Category	Water	Sample Code	WT23090189
Sample Name	Surface Water	Sample Received on	08-09-2023
Sample Description by Customer	Surface Water	Temperature @ Receipt	4°C
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sample Quantity & Packing	2 L & 125 ml in a Plastic Bottle	Test Completed on	14-09-2023
Information Provided by Customer	---	Sampled by	Lab Authorized Sampler
Latitude	11°19'44.44"N	Longitude	76° 2'59.07"E

DETAILS OF SAMPLING

Sample Source	4 th Ordes Thodu Near Mankayam check day 2.85 KM From ML Area in North West Direction	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/QAD/SOP/7.3/01	Sample Temperature	26°C

SAMPLING SITE DETAILS

Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
1	Turbidity	IS 3025 (Part 10):1984	NTU	16.4	1 (Max)
2	pH	IS 3025 (Part 11):1983	---	6.76	6.50-8.50
3	Total Dissolved Solids	IS 3025 (Part 16): 1984	mg/L	35.2	500 (Max)
4	Total Alkalinity as CaCO ₃	IS 3025 (Part 23):1986	mg/L	11.9	200(Max)

Checked by:



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Laju P.N.
Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No: TC1219123000000374F

LRI No.:SEAAL23090908A

Date: 15-09-2023

Page 2 of 2

TEST RESULTS- CHEMICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
5	Total Hardness as CaCO ₃	IS 3025 (Part 21):2009	mg/L	6.00	200(Max)
6	Chloride as Cl	IS 3025 (Part 32):1988	mg/L	4.03	250(Max)
7	Sulphate as SO ₄	IS 3025 (Part 24):1986	mg/L	8.07	200 (Max)
8	Nitrate as NO ₃	APHA 23 rd Edition 4500-NO3 B 2017	mg/L	<1.00	45(Max)
9	Fluoride as F	IS 3025 (Part 60): 2008	mg/L	<0.10	1.0(Max)
10	Magnesium as Mg	IS 3025 (Part 46): 1994	mg/L	<1.00	30 (Max)
11	Iron as Fe	IS 3025 (Part 53):2003	mg/L	3.38	1.00 (Max)
12	Ammonia as total ammonia -N	IS 3025 (Part 34):1988	mg/L	<0.01	0.5 (Max)
13	Lead as Pb	IS 3025 (Part 47): 1994	mg/L	BDL (LOD-0.01)	0.01 (Max)
14	Copper as Cu	IS 3025 (Part 42): 1992	mg/L	BDL (LOD-0.016)	0.05 (Max)
15	Cadmium as Cd	IS 3025 (Part 41): 1992	mg/L	BDL (LOD-0.003)	0.003 (Max)
16	Mercury as Hg	IS 3025 (Part 48): 1994	mg/L	BDL (LOD-0.001)	0.001 (Max)
17	Zinc as Zn	APHA 23 rd Edition 3111B:2017	mg/L	BDL (LOD-0.008)	5.00 (Max)
18	Arsenic as As	APHA 23 rd Edition 3114C:2017	mg/L	BDL (LOD-0.001)	0.01 (Max)
19	Chromium as Cr	IS 3025 (Part 52): 2003	mg/L	BDL (LOD-0.05)	0.05 (Max)
20	Nickel as Ni	IS 3025 (Part 54): 2003	mg/L	BDL(LOD-0.02)	0.02 (Max)
21	Dissolved Oxygen	IS 3025 (Part 38): 1989	mg/L	6.80	---
22	Biochemical Oxygen Demand(3 days at 27 °C)	IS 3025 (Part 44): 1993	mg/L	<2.00	---
23	Chemical Oxygen Demand	IS 3025 Part 58: 2006	mg/L	<4.00	---

TEST RESULTS - BIOLOGICAL DISCIPLINE

Sl. No.	PARAMETERS	TEST METHOD	UNIT	RESULT	Requirement as per Acceptable Limit of IS 10500: 2012
1	Total Coliform Bacteria	IS 15185: 2016	----	Present/100 ml	Absent/100 ml
2	E coli	IS 15185: 2016	----	Absent/100 ml	Absent/100 ml

Remarks:

End of Report

Checked by:



Remya B
TM-Biological
Authorized Signatory

Laiju P N
Laboratory Head
Authorized Signatory

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Protocols followed for Ambient Noise Level Monitoring & methodology

1. The microphone of instrument was kept clean & free from any dust.
2. The equipment used was properly calibrated and calibration status of equipment to be used for monitoring.
3. The CPCB methodology was used for monitoring.
4. Only Type-II noise level monitoring instrument (Sound level meter) was used for monitoring.
5. The laboratory personnel were competent to carryout spot calibration.
6. The field sampling dates were informed well in advance to depute experts at site during the field measurement.
7. Trained & competent manpower with adequate numbers were provided on site for field measurement.
8. For the purposes of selection of sampling location, the sensitive receptors which are near to the mine lease area are considered.

TEST REPORT

ULR No.: TC121912300000360F

LRI No.: SEAAL23090894A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

DETAILS OF MONITORING

Product Category	Atmospheric Pollution	Sample Code	EN23090193
Sample Name	Ambient Noise	Monitoring Commenced on	07-09-2023 (11:00 Hrs)
Test Method	IS 9989:1981	Monitoring Completed on	07-09-2023 (18:00 Hrs)
Monitoring Location	Project Site	Monitored by	Lab Authorized Sampler
Latitude	11°18'38.61"N	Longitude	76°04'17.69"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

MONITORING RESULTS - Leq

TIME (Hrs)	RESULTS dB(A)	TIME (Hrs)	RESULTS dB(A)
11:00	54.0	15:00	51.2
12:00	51.2	16:00	52.4
13:00	50.4	17:00	52.8
14:00	50.8	18:00	47.3


Sl. No.	PARAMETERS	UNIT	RESULT
1	Ambient Sound Level (Leq) (11:00 Hrs to 19:00 Hrs)	dB(A)	49.3

Remarks:

End of Report



Checked by:



Laiju P N
Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No: TC121912300000361F

LRI No.: SEAAL23090895A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address **M/s Mukkom Property Developers Pvt. Ltd.**
Kumaranellor, Kozhikode District.

Customer Reference Test Request date: 07-09-2023

DETAILS OF MONITORING

Product Category	Atmospheric Pollution	Sample Code	EN23090194
Sample Name	Ambient Noise	Monitoring Commenced on	07-09-2023 (11:00 Hrs)
Test Method	IS 9989:1981	Monitoring Completed on	07-09-2023 (18:00 Hrs)
Monitoring Location	Own house of M/s Mukkam properties	Monitored by	Lab Authorized Sampler
Latitude	11°18' 45.70"N	Longitude	76°4' 0.87"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

MONITORING RESULTS - Leq

TIME (Hrs)	RESULTS dB(A)	TIME (Hrs)	RESULTS dB(A)
11:00	53.5	15:00	50.8
12:00	50.8	16:00	52.0
13:00	50.1	17:00	52.4
14:00	50.4	18:00	46.9


Sl. No.	PARAMETERS	UNIT	RESULT
1	Ambient Sound Level (Leq) (11:00 Hrs to 18:00 Hrs)	dB(A)	48.9

Remarks:

End of Report



Checked by:



Laiju P N
Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No: TC121912300000362F

LRI No.: SEAL23090896A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

DETAILS OF MONITORING

Product Category	Atmospheric Pollution	Sample Code	EN23090195
Sample Name	Ambient Noise	Monitoring Commenced on	07-09-2023 (11:00 Hrs)
Test Method	IS 9989:1981	Monitoring Completed on	07-09-2023 (18:00 Hrs)
Monitoring Location	Near Mary Girl High School, Koodaranhi - Maranchatty Rd, Maranchatty	Monitored by	Lab Authorized Sampler
Latitude	11°19'14.78"N	Longitude	76°03'33.94"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

MONITORING RESULTS - Leq

TIME (Hrs)	RESULTS dB(A)	TIME (Hrs)	RESULTS dB(A)
11:00	52.3	15:00	49.6
12:00	49.6	16:00	50.8
13:00	48.9	17:00	51.2
14:00	49.3	18:00	45.9

Sl. No.	PARAMETERS	UNIT	RESULT
1	Ambient Sound Level (Leq) (11:00 Hrs to 18:00 Hrs)	dB(A)	47.7

Remarks:

End of Report

Checked by: 





Laju P N
Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No: TC121912300000363F

LRI No.: SEAAL23090897A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

DETAILS OF MONITORING

Product Category	Atmospheric Pollution	Sample Code	EN23090196
Sample Name	Ambient Noise	Monitoring Commenced on	07-09-2023 (11:00 Hrs)
Test Method	IS 9989:1981	Monitoring Completed on	07-09-2023 (18:00 Hrs)
Monitoring Location	Near IHRD College of Applied Science	Monitored by	Lab Authorized Sampler
Latitude	11°18' 36.61"N	Longitude	76°03' 16.72"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

MONITORING RESULTS - Leq

TIME (Hrs)	RESULTS dB(A)	TIME (Hrs)	RESULTS dB(A)
11:00	52.4	15:00	35.7
12:00	49.8	16:00	35.8
13:00	49.0	17:00	38.4
14:00	49.4	18:00	39.1

Sl. No.	PARAMETERS	UNIT	RESULT
1	Ambient Sound Level (Leq) (11:00Hrs to 18:00Hrs)	dB(A)	47.9

Remarks:

End of Report


Checked by:




Laju P N
Laboratory Head
Authorized Signatory

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Standards Environmental & Analytical Laboratories

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No: TC121912300000364F

LRI No.: SEAAL23090898A	Date: 15-09-2023	Page 1 of 1
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CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

DETAILS OF MONITORING

Product Category	Atmospheric Pollution	Sample Code	EN23090197
Sample Name	Ambient Noise	Monitoring Commenced on	07-09-2023 (11:00 Hrs)
Test Method	IS 9989:1981	Monitoring Completed on	07-09-2023 (18:00 Hrs)
Monitoring Location	Fathimabi Memorial HS School, Koombara	Monitored by	Lab Authorized Sampler
Latitude	11°19' 10.72"N	Longitude	76°04' 38.23"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

MONITORING RESULTS - Leq

TIME (Hrs)	RESULTS dB(A)	TIME (Hrs)	RESULTS dB(A)
11:00	53.0	15:00	50.3
12:00	50.3	16:00	51.5
13:00	49.5	17:00	51.8
14:00	49.9	18:00	46.5


Sl. No.	PARAMETERS	UNIT	RESULT
1	Ambient Sound Level (Leq) (11:00 Hrs to 18:00 Hrs)	dB(A)	48.4

Remarks:

End of Report

Checked by: 




Laiju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No: TC1219123000000365F

LRI No.: SEAAL23090899A	Date: 15-09-2023	Page 1 of 1
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CUSTOMER DETAILS	
Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

DETAILS OF MONITORING			
Product Category	Atmospheric Pollution	Sample Code	EN23090198
Sample Name	Ambient Noise	Monitoring Commenced on	07-09-2023 (11:00 Hrs)
Test Method	IS 9989:1981	Monitoring Completed on	07-09-2023 (18:00 Hrs)
Monitoring Location	Government U P School, Chundathupoyil	Monitored by	Lab Authorized Sampler
Latitude	11°17' 46.07"N	Longitude	76°04' 19.29"E

SAMPLING SITE DETAILS			
Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

MONITORING RESULTS - Leq			
TIME (Hrs)	RESULTS dB(A)	TIME (Hrs)	RESULTS dB(A)
11:00	52.6	15:00	49.9
12:00	49.9	16:00	51.1
13:00	49.1	17:00	51.4
14:00	49.5	18:00	46.1

Sl. No.	PARAMETERS	UNIT	RESULT
1	Ambient Sound Level (Leq) (11:00Hrs to 18:00Hrs)	dB(A)	48.0

Remarks:

End of Report

Checked by:



Laiju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: sealab@gmail.com

ECOLOGICAL ASSESSMENT REPORT (CORE ZONE & 10 KM BUFFER ZONE)

**PREPARED FOR PROPOSED QUARRY PROJECT
OF
M/s MUKKOM PROPERTY DEVELOPERS PVT. LTD.
WITH MINE LEASE AREA OF 8.1765 HA.
At
Survey No. (Un survey), Kumaranellor Village, Kozhikode Taluk,
Kozhikode District, Kerala.**

**Prepared by QCI / NABET approved Functional Area Expert
of Ecology & Biodiversity
M/s Environmental Engineers & Consultants Pvt. Ltd.
Head Office Address :- A1 – 198, Janak Puri, New Delhi – 110058.
Ph. No. 011-25507190 , 45792316, Telefax No. 011-25622604**

**Branch Office Address: -
M/s Environmental Engineers & Consultants Pvt. Ltd.
Apartment No. 306, Kanchanjunga Apartments,
Palarivattom, Kochi, Ernakulam, Kerala-682025.**

CORE ZONE

1.1 Ecological Environment

1.1.1 Introduction

The Quarrying activity affects the terrestrial ecological environment. Therefore, a primary survey on the ecological assessment of the site (flora and fauna) is required to be carried out.

1.1.2 Methodology

Flora

The Qualitative floral Assessment was done by quadrat method. The quadrat is a square sample area of varying size marked-off in the plant community for the purpose of detailed study. Generally a number of quadrats are studied to acquire reasonably faithful data to realise different analytic and synthetic characters of the plant community. The quadrat method includes lying down of a square sample plot of suitable size randomly for detailed analysis of vegetation. It may be a single sample plot or may be divided into several subplots. In the present study, entire project area was sampled for the analysis of tree diversity. Quadrats of 5m x5m and 1m x1m were used for shrubs and herbaceous communities respectively. For the 10 km Buffer zone analysis, we used Belt Transect method for Floral Assessment. Secondary data are also used for the preparation of the biodiversity report of the buffer zone.

Fauna

Birds, Butterflies, Odonates: Line Transect & Point count method

Mammals: Line Transect method, Consultation with local people

Amphibians: Transect and Patch Sampling

Spiders: Searching and Direct Observations

1.1.3 Findings

Flora

Analysis of the flora revealed that there are 124 plant species falling under 54 plant families. Angiosperms forms 119 species with 26 species of trees including saplings, 27 species of shrubs, 45 species of herbs and 21 species of climbers. There are five Pteridophytes (ferns) falling under four families.

The Site has 124 species of plants. It consists of:

Trees	:	20 species
Tree saplings	:	18 species
Shrubs	:	27 species

Herbs : 45 species
Climbers : 21 species
Ferns : 5 species

The list of floral species (trees, tree saplings, shrubs, herbs, climbers, ferns) observed in the site area is provided at table 1.1.

**Table 1.1 - List of floral species observed in the site area
(Trees, tree saplings, shrubs, herbs, climbers and ferns)**

List of trees									
SN	Botanical Name	Common Name	Family	Habitat	Distribution	Numbers		Uses	Status
						Minable area	Buffer zone		
1	<i>Anacardium occidentale</i> L.	Kasumavu	Anacardiaceae	Cultivated	Native of South America; now widely cultivated in Asia and Africa	1	0	Edible, Traditional medicine, Firewood	
2	<i>Trema orientalis</i> (L.) Bl.	Pottaama	Ulmaceae	Dry and moist deciduous forests, also in the plains		3	0	Fire wood	
3	<i>Carica papaya</i> L.	Papaya	Caricaceae	Cultivated	Native of Tropical America	1	0	Edible	
4	<i>Lanea coromandelica</i> (Houtt.) Merr.	Uthi/ Karayam	Anacardiaceae	Deciduous forest, also in the plains	Indo- Malaysia and China	1	0	Firewood	
5	<i>Terminalia bellerica</i>	Thani	Combretaceae	Hills 900-1400m. Indian subcontinent.		1	0	Timber	
6	<i>Cassia fistula</i> L.	Kanikkonna	Caesalpiniaceae	Found in deciduous forests from plains to 1400m. Often planted along the roadsides.	Indo-Malesia	1	0	Avenue tree, Firewood	
7	<i>Wrightia tinctoria</i> R.Br.	Dandappala	Apocynaceae	Moist and dry deciduous forests, also in the plains	India, Myanmar and Timor	1	0	Medicina, Firewood	
8	<i>Zanthoxylum rhetsa</i>	Kothumurikku/	Rutaceae	Evergreen and	Indo-Malesia	3	0	Medicina,	

	(Roxb.) DC.	Mullilam/Muriku		moist deciduous forests, also in the plains				Firewood	
9	<i>Swietenia mahagoni</i> (L.) Jacq.	Mahagony	Meliaceae	Grown as avenue tree		1	0	Timber, Firewood	
10	<i>Xylocarpus xylocarpa</i> (Roxb.) Taub.	Irul	Mimosaceae	Moist deciduous forests, also in the plains	Indo-Malesia	1	4		
11	<i>Spathodea campanulata</i>	Sphaathoodiya	Bignoniaceae	Plains to High Altitude, Cultivated,	Native of Tropical Africa	1	0		
12	<i>Tectona grandis</i> L.f.	Thekku	Verbenaceae	Moist deciduous forests, also raised in plantations	South and South East Asia	2	1	Timber	
13	<i>Artocarpus heterophyllus</i> Lam.	Plavu	Moraceae	Evergreen and semi-evergreen forests, also widely cultivated	Widely cultivated in the tropics, origin is probably South India	3	0	Edible, Timber, Traditional medicine, Firewood	
14	<i>Bombax ceiba</i> L.	Elavu	Bombacaceae	Moist deciduous and semi-evergreen forests, also in the plains	Tropical Asia and New Guinea	3	1	Traditional medicine, Firewood	
15	<i>Macaranga peltata</i> (Roxb.) Müll.Arg.	Vatta	Euphorbiaceae	Moist deciduous and secondary forests, also in the plains	India, Sri Lanka and Andamans	16	3	Pulp and Plywood industry, Firewood	
16	<i>Hevea brasiliensis</i> (Willd. ex Juss.) Muell.-Arg.	Rubber	Euphorbiaceae	Cultivated	Native of Tropical America	1600 Aprox.	150	Rubber and Plywood Industry	
17	<i>Ficus exasperata</i>	Parakam	Moraceae	Moist deciduous	East Africa,	1	0	Traditional	

	Vahl.			forests, also in the plains	Arabia, India and Sri Lanka			medicine	
18	<i>Ficus hispida</i> L.f.	Erumanakku/ Parakam/ Thonditherakam	Moraceae	Moist deciduous and semi-evergreen forests, also in the plains	Indo-Malesia to Australia	1	0	Traditional medicine, Firewood	
19	<i>Caryota urens</i> L.	Choonda/ Choondappana	Arecaceae	Evergreen forests, also in the plains	Indo-Malaysia	1	0	Medicina, Toddy, Elephant fodder	
20	<i>Mallotus tetracoccus</i>	Porivatta,	Euphorbiaceae	Evergreen forests	Indo-Pacific	1	0	Firewood, Traditional medicine	
					TOTAL	1643	159		

List of trees sapling

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Uses	Status
1	<i>Lannea coromandelica</i> (Houtt.) Merr.	Uthi/ Karayam	Anacardiaceae	Deciduous forest, also in the plains	Indo- Malaysia and China	Firewood	
2	<i>Macaranga peltata</i> (Roxb.) Müll.Arg.	Vatta	Euphorbiaceae	Moist deciduous and secondary forests, also in the plains	India, Sri Lanka and Andamans	Pulp and Plywood industry, Firewood	
3	<i>Ficus tsjahela</i> Burm.f.	Karal/Kara/C hela	Moraceae	Moist deciduous forests, also in the plains; often epiphytic and later becoming independent	Peninsular India and Sri Lanka	Traditional Medicine, Firewood	

4	<i>Hevea brasiliensis</i> (Willd. ex Juss.) Muell.-Arg.	Rubber	Euphorbiaceae	Cultivated	Native of Tropical America	Rubber and Plywood Industry	
5	<i>Tabernaemontana alternifolia</i> L.	Kunnanpala	Apocynaceae	Along margin of the evergreen forests and common in moist deciduous forest, up to 850 m.	Western Ghats	Traditional medicine	Endemic to the Western Ghats
6	<i>Anacardium occidentale</i> L.	Kasumavu	Anacardiaceae	Cultivated	Native of South America; now widely cultivated in Asia and Africa	Edible, Traditional medicine, Firewood	
7	<i>Mallotus philippensis</i> (Lam.) Muell.-Arg.	Kapila	Euphorbiaceae	Semi-evergreen, moist deciduous, evergreen and dry deciduous forests, also in the plains	Indo-Malesia and Australia	Firewood, Traditional medicine	
8	<i>Caryota urens</i> L.	Choonda/ Choondappana	Arecaceae	Evergreen forests, also in the plains	Indo-Malaysia	Medicina, Toddy, Elephant fodder	
9	<i>Artocarpus heterophyllus</i> Lam.	Plavu	Moraceae	Evergreen and semi-evergreen forests, also widely cultivated	Widely cultivated in the tropics, origin is probably South India	Edible, Timber, Traditional medicine, Firewood	
10	<i>Mangifera indica</i> L.	Mavu	Anacardiaceae	Evergreen and semi-evergreen forests and also widely cultivated	Indo-Malaysia	Edible, Timber, Traditional medicine, Firewood	
11	<i>Ficus hispida</i> L.f.	Erumanakku/ Parakam/ Thonditherakam	Moraceae	Moist deciduous and semi-evergreen forests, also in the plains	Indo-Malesia to Australia	Traditional medicine, Firewood	

12	<i>Tectona grandis</i> L.f.	Thekku	Verbenaceae	Moist deciduous forests, also raised in plantations	South and South East Asia	Timber	
13	<i>Ficus exasperata</i> Vahl.	Parakam	Moraceae	Moist deciduous forests, also in the plains	East Africa, Arabia, India and Sri Lanka	Traditional medicine	
14	<i>Spathodea campanulata</i>	Sphaathhoodiya	Bignoniaceae	Plains to High Altitude, Cultivated,	Native of Tropical Africa	Avenue tree, firewood	
15	<i>Artocarpus hirsutus</i> Lam.	Anjili	Moraceae	Semi-evergreen and moist deciduous forests, also in the plains	Southern Western Ghats	Edible, Timber, Traditional medicine, Firewood	Endemic to Southern Western Ghats
16	<i>Mallotus tetracoccus</i>	Porivatta,	Euphorbiaceae	Evergreen forests	Indo-Pacific	Firewood, Traditional medicine	
17	<i>Alstonia scholaris</i> (L.) R. Br.	Ezhilampala/ Devil Tree	Apocynaceae	Moist deciduous forests and sacred groves, also in the plains	South and South East Asia to Australia	Avenue tree, Firewood, Traditional medicine	
18	<i>Trema orientalis</i> (L.) Bl.	Pottaama	Ulmaceae	Dry and moist deciduous forests, also in the plains		Firewood	

List of Shrubs

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Uses	Status
1	<i>Helicteres isora</i>	Edampiri-Valampiri	Malvaceae	Deciduous forests, also in plantations and plains	Indo-Malesia, China and Australia	Traditional Medicine	
2	<i>Grewia nervosa</i> (Lour.) Panigrahi.	Cherikkotta	Malvaceae	Semi-evergreen forests, sacred groves and scrub jungles	Tropical Asia	Traditional Medicine	

3	<i>Canthium angustifolium</i> Roxb.	Kattakara	Rubiaceae	Moist deciduous, semi-evergreen and evergreen forests	India and Myanmar	Traditional Medicine	
4	<i>Urena lobata</i> L.	Uram	Malvaceae	Moist deciduous forests and in the plains	Pantropical	Traditional Medicine	Exotic
5	<i>Lantana camara</i> L.	Kongini	Verbenaceae	Most aggressive weed of disturbed ground from plains to the hills.	Native of tropical America, widely naturalised in tropics and subtropics.	Traditional Medicine, Ornamentals	Invasive Species
6	<i>Aerva lanata</i> (L.) A.L.Juss.	Cherula	Amaranthac eae	Common wayside weed by arable lands, fallow fields.	Widespread in the tropics and subtropics	Traditional Medicine	
7	<i>Ziziphus oenoplia</i>	Thudaly	<i>Rhamnaceae</i>	It grows along roadside forests and thickets	Tropical and subtropical Asia and Australasia.	Traditional Medicine	
8	<i>Bambusa bambos</i>	Illi, Kaniyaram,	Poaceae	Deciduous forests	Indo-Pacific	Traditional Medicine, Handicraft Industry	
9	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Communist- pacha	Compositae	A weed in all terrestrial habitats	Native of America; naturalised in Tropical Asia	Traditional Medicine	Exotic/Invasi ve Species
10	<i>Chassalia curviflora</i> (Wall.) Thwaites		Rubiaceae	Degraded forests	Indo-Malesia	Traditional Medicine	
11	<i>Hibiscus hispidissimus</i> Griff.	Matthippuli	Malvaceae	Dry and moist deciduous forests, also in the plains	Paleotropics	Traditional Medicine, Edible	

12	<i>Ixora coccinea</i> L.	Thechi/ Chethi	Rubiaceae	In the plains, also grown in homesteads	Peninsular India and Sri Lanka	Traditional Medicine, Ornaments	
13	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Panal	Rutaceae	Semi-evergreen and moist deciduous forests, also in the plains	Indo-Malesia	Traditional Medicine	
14	<i>Hyptis suaveolens</i> (L.) Poit.	Nattapoochedi	Lamiaceae	Degraded moist and dry deciduous forests and wastelands	Originally from America now Pantropical	Traditional Medicine	Invasive Species
15	<i>Getonia floribunda</i> Roxb.	Pullanni	Combretaceae	Moist deciduous forest, also in the plains	Indo-Malesia	Traditional Medicine	
16	<i>Breynia vitis-idaea</i> (Burm.f)	Kattuniruri	Euphorbiaceae	Semi –evergreen and moist deciduous forest, also in the plains	Indo-Malesia	Traditional Medicine	
17	<i>Clerodendrum infortunatum</i> L.	Perivelam	Verbenaceae	Degraded forest areas and also in the plains	Indo-Malesia	Traditional Medicine	
18	<i>Clidemia hirta</i> (L.) D. Don		Melastomataceae	Degraded forest areas	Native of South America; naturalised in Paleotropics	Traditional Medicine	
19	<i>Acacia pennata</i> (L.) Willd	Karincha	Leguminosae	Moist deciduous forest	Paleotropics	Traditional Medicine	
20	<i>Syzygium zeylanicum</i> (L.) DC.	Poocha pazham	Myrtaceae	Banks of streams in evergreen forests	Indo-Malesia	Traditional Medicine	

21	<i>Ziziphus rugosa Lam.</i>	Kottamullu	Rhamnaceae	Common on exposed and dry slopes and forest edges from 900-1500m. Peninsular India.	India, Sri Lanka, Bangladesh and Myanmar	Traditional Medicine	
22	<i>Sauropus andogynus (L.) Merr.</i>	Velicheera	Euphorbiaceae	Evergreen and semievergreen forest and also grown in homesteads	Indo-Malesia	Edible, Traditional Medicine	
23	<i>Solanum violaceum ssp. Violaceum.</i>	Cheruchunda	Solanaceae	Plains, Dry Localities/ Cleared Forests	Indo Malesia	Traditional Medicine	
24	<i>Senna occidentalis (L.) Link</i>	Mattantakara	Caesalpiniaee	Along roadsides and waste lands	Native of South America; naturalised in Asia	Traditional Medicine	
26	<i>Mussaenda frondosa L.</i>	Vellila	Rubiaceae	Moist deciduous and semi-evergreen forests, also in the plains	Peninsular India	Traditional Medicine	
27	<i>Phyllanthus reticulatus Poir.</i>	Nirnelli/Oory	Phyllanthaceae	Stream banks, lake shores and also in moist deciduous and semi-evergreen forests	Paleotropics	Traditional Medicine	

List of Herbs

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Uses	Status
1	<i>Lindernia crustacea (L.) F.v.Muell.</i>	Brittle False Pimpernel/Malaysian False Pimpernel	Scrophulariaceae	Moist deciduous forests and waste lands	Africa, America and Tropical and Subtropical Asia	Traditional Medicine	
2	<i>Physalis minima</i>	<i>Njodinjotta, Njottanjodian</i>	Solanaceae	Degraded forests	Indo-Pacific, African and Australian	Traditional Medicine	
3	<i>Euphorbia hirta L.</i>	Nilappaala	Euphorbiaceae	Degraded forest areas	Pantropical.	Traditional	

				and forest plantations, also in the plains		Medicine	
4	<i>Tridax procumbens</i> L.	Odiyancheera	Asteraceae	Deciduous forests, also waste lands in the plains	Native of Tropical America; now widespread throughout tropics and subtropics	Traditional Medicine	Exotic
5	<i>Spermacoce ocymoides</i> Burm.f.	Tharakeera	Rubiaceae	Wastelands	Indo-Malesia and Tropical Africa	Traditional Medicine	
6	<i>Mitracarpus hirtus</i> (L.) DC.	Thaval	Rubiaceae	Degraded moist deciduous forests and wastelands	Tropical Africa and America; now common in South India	Traditional Medicine	
7	<i>Commelina diffusa</i> Burm.	Creeping dayflower	Commelinaceae	Wastelands	Pantropical	Traditional Medicine	
8	<i>Cyanotis cristata</i> (L.) D.Don.		Commelinaceae	Grasslands, degraded forest areas and wastelands	Paleotropics	Fodder	
9	<i>Synedrella nodiflora</i> (L.) Gaertn.	Mudianpacha	Compositae	Deciduous forests, also in the plains	Native of West Indies; naturalised in India, China, Malesia and Polynesia	Traditional Medicine, Fodder	Exotic
10	<i>Vernonia cinerea</i> (L.) Less.	Puvankurunal	Compositae	Deciduous forests, also in the plains	Pantropics	Traditional Medicine	Exotic
11	<i>Axonopus compressus</i> (Sw.) P.Beauv.	Kaalappullu/ Carpet Grass	Poaceae	Dry and moist deciduous forests, waste lands	Tropics and subtropics	Fodder	
12	<i>Tragia involucrata</i>	Choriyanam	Euphorbiaceae	Wastelands	India and Sri Lanka	Traditional Medicine	
13	<i>Mimosa pudica</i> L.	Thottavadi	Leguminosae	Common on moist and ungrazed places. Near riverbanks, bunds of arable lands, fallow lands and water courses.	Native of South America, now pantropical.	Traditional Medicine	Exotic

14	<i>Biophytum sensitivum</i> (L.) DC.	Theendavadi/Mukku ti	Oxalidaceae	Moist shady places	Indo-Malesia	Traditional Medicine	
15	<i>Colocasia esculenta</i> (L.) Schott	Chembu	Araceae	Waterlogged ditches and streamside	Pantropical	Traditional Medicine, Edible	Invasive Species
16	<i>Scoparia dulcis</i> L.	Kallurukki	Plantaginaceae	Wasteplaces	Native of Tropical America; now Pantropical	Traditional Medicine	Exotic
17	<i>Sida rhombifolia</i> L.	Kurunthotti	Malvaceae	Wastelands, also in degraded forest areas	Pantropical	Traditional Medicine	
18	<i>Pennisetum orientale</i> Rich.		Poaceae	Cultivated as fodder grass, often found running wild	Central Asia and North Africa	Fodder	
19	<i>Ageratum conyzoides</i> L.	Appa	Compositae	Most abundant weed of disturbed ground and fallows, damp places and forest undergrowth.	Pantropical	Traditional Medicine	Exotic
20	<i>Desmodium triflorum</i> (L.) DC.	Nilamparanda/ Cherupalladi	Leguminosae	Grasslands and moist deciduous forests, also in plains	Indo-Malesia and Australia	Traditional Medicine	
21	<i>Cheilocostus speciosus</i> (J.König) C.Specht	Channakoova	Costaceae	Moist deciduous and semi-evergreen forests, also in the plains	Indo-Malesia	Traditional Medicine	
22	<i>Kyllinga nemoralis</i> (J.R.Forst. & G.Forst.)	Vallimuthanga/ Whitehead spikesedge	Cyperaceae	Waste places, degraded forest areas and grasslands	Pantropical	Traditional Medicine	
23	<i>Caladium bicolor</i> (Aiton) Vent.	Colour Chembu	Araceae	Wastelands in the plains	South America; now naturalised in the tropics	Ornamentals	Exotic
24	<i>Brachiaria ramosa</i> (L.) Stapf	Chamapothaval	Gramineae	Grasslands and moist deciduous forests, roadsides and wastelands	Africa and Tropical Asia	Fodder	

25	<i>Sida acuta</i> Burm.f.	Malamkurunthotti	Malvaceae	Dry and moist deciduous forests, also in the plains	Pantropical	Traditional Medicine	
26	<i>Elephantopus scaber</i> L.	Aanachuvadi	Compositae	Moist deciduous forests, also in the plains	Pantropical	Traditional Medicine	
27	<i>Triumfetta rhomboidea</i> Jacq.	Ottukayal/ Oorpam	Malvaceae	Degraded deciduous forests, also in the plains	Pantropical	Traditional Medicine	
28	<i>Acampe praemorsa</i>	Maravazha	Orchidaceae	Moist deciduous forests	Indo-Pacific and African	Traditional Medicine	
29	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Kakkakalan pullu	Poaceae	Marshy lands and open areas	Native of South America, naturalised in Paleotropics	Fodder	
30	<i>Emilia sonchifolia</i> (L.) DC.	Muyalchevian	compositae	Dry and moist deciduous forests, also in the plains	Tropical and Subtropical Africa and Asia	Traditional Medicine	Exotic
31	<i>Stachytarpheta jamaicensis</i> (L.) Vahl		Verbenaceae	Dry and moist deciduous forests, also in the plains	Pantropical	Traditional Medicine	
32	<i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees	Nilavepu	Acanthaceae	Scrub jungles, also in the plains	Peninsular India and Sri Lanka	Traditional Medicine	
33	<i>Phyllanthus urinaria</i> L.	Chirukizhukanelli	Phyllanthaceae	In the plains, also in degraded deciduous forests	Native of Tropical East Asia; now a Circumtropical weed	Traditional Medicine	Medicinal
34	<i>Naregamia alata</i> Wight & Arn.	Nilanaragam	Meliaceae	Moist deciduous forests, also in the plains	Peninsular India	Traditional Medicine	Endemic Peninsular India
35	<i>Senna tora</i> (L.) Roxb.	Thakara	Leguminosae	Moist deciduous forests, also in the plains	Native of South America	Traditional Medicine	Invasive Species
36	<i>Ruellia prostrata</i> Poir	Irula	Acanthaceae	Found in the disturbed areas, foot paths and agricultural lands	India	Traditional Medicine	
37	<i>Alysicarpus vaginalis</i> var. <i>vaginalis</i>	Nila-orila	Leguminosae	Wastelands in the plains	Paleotropics	Traditional Medicine	

38	<i>Zornia diphylla</i> (L.)	Murikkotti	Leguminosae	Lateritic grassy slopes, forest plantations, also in the plains	India and Sri Lanka	Traditional Medicine	
39	<i>Peperomia pellucida</i> (L.) Kunth.	Mashitandu Chedi	Piperaceae	Degraded forest areas and wastelands	Native of Tropical America; now Pantropical	Traditional Medicine	Exotic
40	<i>Curcuma neilgherrensis</i>	Koova	Zingiberaceae	Grasslands	Endemic to Western Ghats	Traditional Medicine	
41	<i>Torenia bicolor</i> Dalz.	Kakkapoovu	Scrophulariaceae	Marshy areas	Western Ghats	Traditional Medicine	Endemic to Western Ghats
42	<i>Capsicum frutescens</i> cv. Nagahari	Kantharimulaku	Solanaceae	Cultivated	Tropica America:widely cultivated	Edible, Traditional Medicine	Exotic
43	<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.	Kolinchi	Zingiberaceae	Evergreen forests	India, Sri Lanka and Malesia	Traditional Medicine	
44	<i>Achyranthes bidentata</i> Blume	Cherukadaladi	Amaranthaceae	Evergreen forests	Indo-Malesia to Australia and East Asia	Traditional Medicine	
45	<i>Impatiens maculata</i>		Balsaminaceae	Stream banks	Southern Western Ghats	Endemic to Southern Western Ghats	

List of Climbers

Sl. No.	Botanical Name	Common Name	Family	Habitat	Distribution	Uses	Status
1	<i>Wattakaka volubilis</i> (L.f.) Stapf.	Vattakakkakkoti	Aslepiadaceae	Moist deciduous forests and scrub jungles	Indo-Malesia and China	Traditional Medicine	
2	<i>Calycopteris floribunda</i> (Roxb.) Lam. ex Poir.	Pullani	Combretaceae	Moist deciduous forest, also in the plains	Indo-Malesia	Traditional Medicine	

3	<i>Cardiospermum halicacabum</i> L.	Uzhinja	Sapindaceae	Moist deciduous forests, also in scrub jungles	Pantropical	Traditional Medicine	
4	<i>Cyclea peltata</i> (Lam.) Hook. f. & Thoms.	Padathali	Menispermaceae	Semi-evergreen and evergreen forests, also in the plains	India and Sri Lanka	Traditional Medicine	
5	<i>Ichnocarpus frutescens</i> (L.) R.Br.	Palvalli	Apocynaceae	Moist and dry deciduous forests, also in the plains	Indo-Malesia and Australia	Traditional Medicine	
6	<i>Pueraria phaseoloides</i> (Roxb.) Benth.	Thotta-payar	Leguminosae	Along margins of cultivated lands	Tropical Asia	Fodder, Nitrogen fixing Plant	Invasive Species
7	<i>Pothos scandens</i> L.	Paruvakodi	Araceae	Evergreen forests, waste places and sacred groves	India to Malesia and Madagascar	Traditional Medicine	
8	<i>Hemidesmus indicus</i> R.Br.	Nannaari/Naruneendi	Asclepiadaceae	Sighted growing solitary in tilled or burnt fields. Plains from the coast, in scrub jungles and upto 1000m on the slopes.	India and Sri Lanka.	Traditional Medicine	
9	<i>Passiflora foetida</i> L.	Poodapazham	Passifloraceae	Very common along roadsides, thickets and water courses from plains	Native of tropical America, now widely naturalized the tropics	Traditional Medicine, Edible	Exotic
10	<i>Smilax zeylanica</i> L.	Valiyakanni/Arikanni	Smilacaceae	Moist deciduous and semi-evergreen forests, also in the plains	Indo-Malesia	Traditional Medicine	
11	<i>Centrosema pubescens</i> Benth.	Kattupayar	Leguminosae	Forest plantations and Deciduous forests, also in the plains	Native of America; introduced in India		
12	<i>Tragia involucrata</i> L.	Valli choriyanam/Kodithoova	Euphorbiaceae	Wastelands	India and Sri Lanka	Traditional Medicine	
13	<i>Mukia</i>	Kasappuchedi	Cucurbitaceae	Deciduous forests, also	Paleotropics	Traditional	

	<i>maderaspatana</i> (L.) M.Roem.			in the plains		Medicine	
14	<i>Mikania micrantha</i> Kunth	Vayara	Compositae	Forest plantations and also in the plains in moist localities	Pantropical	Traditional Medicine	Invasive species, climber
15	<i>Dendrophthoe falcata</i> (L.f.) Ettingsh.	Ittikanni	Loranthaceae	Found in foothill scrub jungles and deciduous forests from plains to 1000m.	India, Sri Lanka, Thailand, Indo- China and Australia.	Traditional Medicine	
16	<i>Merrimia tridentata</i>	Prasarini, Talaneeli, Talanili	Convolvulaceae	Open woodland, grassland, cultivated ground, roadsides, sandy soils 40–1500 m		Traditional Medicine	
17	<i>Ziziphus oenopolia</i> (L.) Mill.	Thodalli	Rhamnaceae	More common on the lower slopes. Plains from the coast to 1200m.	Tropical Asia and Australia. Throughout the hotter parts of India	Traditional Medicine	
18	<i>Asparagus racemosus</i> Willd.	Sathavari	Liliaceae	All forest types, also in the plains	Paleotropics	Traditional Medicine	
19	<i>Gloriosa superba</i> L.	Menthonni	Liliaceae	Semi-evergreen, moist deciduous and dry deciduous forests, also in the plains	Paleotropics	Traditional Medicine	
20	<i>Abrus precatorius</i> L.	Kunnikuru	Leguminosae	Deciduous forests, also in the plains	Pantropical	Traditional Medicine	
21	<i>Calamus hookerianus</i>	Velichooral	Arecaceae	Evergreen and Semi- evergreen forest	Western Ghats		Endemic to Western Ghats

List of Ferns						
SN	Botanical Name	Common Name	Family	Habitat	Distribution	Uses
1	<i>Lygodium flexuosum</i> (L.) Sw.	Climbing Fern	Schizaeaceae	Open ground, forming a tangled mass or the very long and wiry fronds twining round surrounding shrubs and trees.	From Sri Lanka and the Himalayas to southern China, Hong Kong, Ryukyu Islands, throughout Southeast Asia to northern Queensland.	
2	<i>Pityrogramma calomelanos</i> (L.) Link	Silver fern	Adiantaceae	Common on open ground in fairly exposed places	American origin, now widely distributed in pan-tropics	
3	<i>Adiantum latifolium</i> Lam.		Adiantaceae	Disturbed open areas.	Native to tropical America	Ornamentals
4	<i>Selaginella tenera</i> Spring.	Sanjeevani	Selaginellaceae	Found commonly on the forest floor and at road side rocks.		Traditional Medicine
5	<i>Drynaria quercifolia</i> (L.) J. Sm.	Basket fern, Oak-leaf fern	Polypodiaceae	Basket ferns are grown on trees or grown on rocks. They can also sometimes be found in man-made structures like brick walls.	Native to tropical Africa, South Asia, East Asia, Southeast Asia, Australia, and Oceania	Traditional Medicine

Fauna

The following lists of faunal elements were observed from the site:

Mammals	:	15 species
Reptiles	:	10 species
Birds	:	35 species
Amphibians	:	6 species
Butterflies	:	37 species
Odonates	:	17 species
Spiders	:	18 species

The list of faunal species (Mammals, Reptiles, Birds, Amphibian, Odonates, Butterflies and Spiders) observed in the site area in table 1.2.

**Table 1.2 - List of faunal species observed in the site area
(Mammals, reptiles, birds, Amphibian, Odonates, Butterflies, Spiders)**

List of Mammals (In and around the project site)

SN	Common Name	Scientific Name	IUCN Status	IW(P)A (Schedule)
1	Indian Porcupine	<i>Hystrix indica</i>	Least Concern	I
2	Common Indian Field Mouse	<i>Mus booduga</i>	Least Concern	V
3	Pig Rat	<i>Bandicota indica</i>	Least Concern	V
4	Three Striped Palm Squirrel	<i>Funambulus palmarum</i>	Least Concern	V
5	House Mouse	<i>Mus musculus</i>	Least Concern	V
6	Common House Rat	<i>Rattus rattus</i>	Least Concern	V
7	Lesser Bandicoot Rat	<i>Bandicota bengalensis</i>	Least Concern	V
8	Jungle Cat	<i>Felis chaus</i>		II
9	Indian Flying Fox	<i>Pteropus giganteus</i>	Least Concern	V
10	Greater Short-nosed Fruit Bat	<i>Cynopterus sphinx</i>	Least Concern	V
11	Indian Wild Boar	<i>Sus scrofa</i>	Least Concern	III
12	Kurunari, Oolan.	<i>Canis aureus</i>		II
13	Palm Civet/Toddy Cat	<i>Paradoxurus hermaphroditus</i>	Least Concern	II
14	Black-Naped Hare	<i>Lepus nigricollis</i>	Least Concern	IV

15	Bonnet Macaque	<i>Macaca radiata</i>	Least Concern	I
16	Common mongoose	<i>Herpestes edwardsi</i>	Least Concern	I

* IW (P) A -The Indian Wildlife (Protection) Act, 1972.

List of Reptiles

SN	Scientific Name	Common Name	IUCN Status
1	<i>Hemidactylus leschenaultii</i>	Bark Gecko	Least Concern
2	<i>Dendrelaphis tristis</i>	Common Indian Bronze-back	Least Concern
3	<i>Ahaetulla nasuta</i>	Common Vine Snake	Not evaluated
4	<i>Eutropis carinata</i>	Common Keeled Skink	Least Concern
5	<i>Vipera russelli</i>	Russell's viper	Not evaluated
6	<i>Ptyas mucosa</i>	Oriental Rat Snake	Least Concern
7	<i>Naja naja</i>	Asian cobra	Least Concern
8	<i>Calotes versicolor</i>	Oriental Garden Lizard	Least Concern
9	<i>Bungarus caeruleus</i>	Common krait	Not evaluated
10	<i>Lycodon aulicus</i>	Common Wolf Snake	Not evaluated

List of Birds

SN	Scientific Name	Common Name	Family	IUCN Status	Remarks
1	<i>Glaucidium radiatum</i>	Jungle Owlet	Strigidae	Least Concern	
2	<i>Dendrocitta vagabunda</i>	Indian Treepie	Corvidae	Least Concern	
3	<i>Hierococcyx varius</i>	Common Hawk Cuckoo	Cuculidae	Least Concern	
4	<i>Columba livia</i>	Blue Rock Pigeon	Pteroclididae	Least Concern	
5	<i>Dicaeum agile</i>	Pale billed Flowerpecker.	Dicaeidae	Least Concern	
6	<i>Oriolus xanthornus</i>	Black hooded oriole	Oriolidae	Least Concern	

7	<i>Athene brama</i>	Spotted owlet	Strigidae	Least Concern	
8	<i>Eudynamys scolopacea</i>	Asian Koel	Cuculidae	Least Concern	
9	<i>Aegithia tiphia</i>	Common Iora	Irenidae	Least Concern	
10	<i>Haliastur indus</i>	Brahminy kite	Accipitridae	Least Concern	
11	<i>Corvus splendens</i>	House Crow	Corvidae	Least Concern	
12	<i>Copsychus saularis</i>	Oriental magpie robin	Muscicapidae	Least Concern	
13	<i>Turdoides striatus</i>	Jungle Babbler	Muscicapidae	Least Concern	
14	<i>Pycnonotus cafer</i>	Red vented Bulbul	Pycnonotidae	Least Concern	
15	<i>Nectarinia zeylonica</i>	Purple-rumped Sunbird	Nectariniidae	Least Concern	
16	<i>Dinopium benghalense</i>	Black-rumped Flameback	Picidae	Least Concern	
17	<i>Treron pompadora affinis</i>	Pompadour Green Pigeon	Columbidae	Least Concern	
18	<i>Nectarinia lotenia</i>	Loten's Sunbird	Nectariniidae	Least Concern	
19	<i>Acridotheres tristis</i>	Common Myna	Sturnidae	Least Concern	
20	<i>Psittacula krameri</i>	Rose ringed parakeet	Psittacidae	Least Concern	
21	<i>Merops orientalis</i>	Small Green Bee Eater	Meropidae	Least Concern	
22	<i>Corvus macrorhynchos</i>	Large billed crow	Corvidae	Least Concern	
23	<i>Pycnonotus jocosus</i>	Red Whiskered Bulbul	Pycnonotidae	Least Concern	
24	<i>Oriolus oriolus</i>	Golden Oriole	Oriolidae	Least Concern	Winter Visitor
25	<i>Hirundo rustica</i>	Barn Swallow	Hirundinidae	Least Concern	Winter Visitor
26	<i>Dicrurus paradiseus</i>	Racket tailed drongo	Dicruridae	Least Concern	
27	<i>Centropus sinensis</i>	Greater coucal	Cuculidae	Least Concern	
28	<i>Accipiter badius</i>	Shikra	Accipitridae	Least Concern	
29	<i>Streptopelia</i>	Spotted dove	Columbidae	Least Concern	

	<i>chinensis</i>				
30	<i>Loriculus vernalis</i>	Indian Hanging Parrot	Psittacidae	Least Concern	
31	<i>Dicrurus macrocercus</i>	Black Drongo	Dicruridae	Least Concern	
32	<i>Pitta brachyura</i>	Indian pitta	Pittidae	Least Concern	Winter Visitor
33	<i>Megalaima viridis</i>	White cheeked barbet	Capitonidae	Least Concern	
34	<i>Pericrocotus flammeus</i>	Scarlet Minivet	Campephagi dae	Least Concern	
35	<i>Chalcophaps indica</i>	Emerald Dove	Columbidae	Least Concern	

List of Amphibians

SN	Scientific Name	Common Name	IUCN Status
1	<i>Rhacophorus malabaricus</i>	Malabar gliding frog	Least Concern
2	<i>Polypedates maculatus</i>	Common Tree Frog	Least Concern
3	<i>Euphlyctis hexadactylus</i>	Green Pond Frog	Least Concern
4	<i>Euphlyctis cyanophlyctis</i>	Indian skipper frog	Least Concern
5	<i>Hoplobatrachus tigerinus</i>	Indian bullfrog	Least Concern
6	<i>Duttaphrynus melanostictus</i>	Indian common toad	Least Concern

List of Odonates

Sl. No.	Scientific Name	Common Name
1	<i>Rhyothemis vareiegata</i>	Common Picture Wing
2	<i>Brachythemis contaminata</i>	Ditch Jewel
3	<i>Pantala flavescens</i>	Wandering Glider
4	<i>Bradinopyga geminata</i>	Granite Ghost
5	<i>Trithemis festiva</i>	
6	<i>Pseudagrion microcephalum</i>	Blue Grass Dart
7	<i>Copera marginipes</i>	
8	<i>Potamarcha congener</i>	Yellow-Tailed Ashy Skimmer
9	<i>Acisoma panorpoides</i>	Asian Pintail
10	<i>Urothemis signata</i>	Greater Crimson Glider

11	<i>Agriocnemis pygmaea</i>	Pygmy Dartlet
12	<i>Diplacodes trivialis</i>	Ground Skimmer
13	<i>Lathrecista asiatica</i>	Asiatic Bloodtail
14	<i>Ictinogomphus rapax</i>	Common Clubtail
15	<i>Gynacantha dravida</i>	Brown Darner
16	<i>Orthetrum taeniolatum</i>	Asian freshwater dragonfly
17	<i>Agriocnemis pygmaea</i>	Pygmy Dartlet

List of Butterflies

SN	Common Name	Scientific Name	Status
Papilionidae			
1	Crimson Rose	<i>Pachliopta hector</i> Linnaeus	
2	Southern Birdwing	<i>Troides minos</i> Cramer	Endemic to W.Ghats
3	Lime Butterfly	<i>Papilio demoleus</i> Linnaeus	
4	Common Mime	<i>Papilio clytia</i> Linnaeus	
5	Blue Mormon	<i>Papilio polymnestor</i>	
6	Common Rose	<i>Pachliopta aristolochiae</i> Fabricius	
7	Tailed Jay	<i>Graphium agamemnon</i> Linnaeus	
8	Common Mormon	<i>Papilio polytes</i> Linnaeus	
Pieridae			
9	Common Emigrant	<i>Catopsilia pomona</i> Fabricius	
10	Psyche	<i>Leptosia nina</i> Fabricius	
11	Three-spot Grass Yellow	<i>Eurema blanda</i> Boisduval	
12	Common Grass Yellow	<i>Eurema hecabe</i> Linnaeus	
Nymphalidae			
13	Common Four-ring	<i>Ypthima huebneri</i> Kirby	
14	Common Bush brown	<i>Mycalesis perseus</i> Fabricius	
15	Clipper	<i>Parthenos sylvia</i> Cramer	
16	Striped Tiger	<i>Danaus genutia</i> Cramer	
17	Common Five-ring	<i>Ypthima baldus</i> Fabricius	
18	Blue Tiger	<i>Tirumala limniace</i> Cramer	

19	Great Eggfly	<i>Hypolimnas bolina</i> Linnaeus	
20	Common Crow	<i>Euploea core</i> Stoll	
21	Common Palmfly	<i>Elymnias hypermnestra</i> Linnaeus	
22	Common Evening Brown.	<i>Melanitis leda</i> Linnaeus	
23	Common Sailer	<i>Neptis hylas</i> Linnaeus	
24	Chocolate Pansy	<i>Junonia iphita</i> Cramer	
25	Double Brand Crow	<i>Euploea sylvester</i>	
26	Angled Castor	<i>Ariadne ariadne</i> Linnaeus	
27	Dark blue tiger	<i>Tirumala septentrionis</i>	
	Lycanidae		
28	Monkey Puzzle	<i>Rathinda amor</i> Fabricius	
29	Lesser Grass Blue	<i>Zizina otis</i>	
30	Common Pierrot	<i>Castalius rosimon</i> Fabricius	
31	Common Line-blue	<i>Prosotas nora</i> C. Felder	
32	Plains Cupid	<i>Chilades pandava</i> Horsfield	
33	Red Pierrot	<i>Talicerca nyseus</i> Guerin-Meneville	
34	Common Cerulean	<i>Jamides celeno</i> Cramer	
	Hesperidae		
35	Suffused Snow Flat	<i>Tagiades gana</i> Moore	
36	Grass Demon	<i>Udaspes folus</i> Cramer	
37	Common Small Flat	<i>Sarangesa dasahara</i> Moore	

List of Spiders

SN	Family	Species Name
1	Tetragnathidae	<i>Teragnatha mandibulata</i>
2	Salticidae	<i>Plexippus paykulli</i>
3	Araneidae	<i>Argiope pulchella</i>
4	Salticidae	<i>Telamonia dimidiata</i>
5	Lycosidae	<i>Hippasa agelenoides</i>
6	Clubionidae	<i>Clubiona drassodes</i>
7	Oxyopidae	<i>Oxyopes bircanicus</i>

8	Araneidae	<i>Gasteragnatha germinate</i>
9	Pisauridae	<i>Pardosa pseudoannulata</i>
10	Thomisidae	<i>Oxytate virens</i>
11	Salticidae	<i>Plexippus petersi</i>
12	Theridiidae	<i>Achaeearanea mundula</i>
13	Araneidae	<i>Eriovixia laglaisei</i>
14	Araneidae	<i>Cyclosa confraga</i>
15	Sparassidae	<i>Hetropoda venatoria</i>
16	Hersilidae	<i>Hersilla savignyi</i>
17	Oxyopidae	<i>Peucetia viridana</i>
18	Salticidae	<i>Menemerus bivittatus</i>

1.8.4 Interpretation of Ecological Assessment

Flora

- The most dominant plant families are Leguminosae and Euphorbiaceae with 9 plant species each followed by Malvaceae, Compositae, Rubiaceae and Moraceae. One tree species namely *Artocarpus hirsutus* is endemic to Southern Western Ghats. Another tree species viz. *Tabernaemontana alternifolia* is Endemic to the Western Ghats. Herb species *Naregamia alata* is endemic to Peninsular India and climber species *Calamus hookerianus* is endemic to Western Ghats. There is no Rare, Endangered or Threatened (RET) Species found in the proposed site area.

Fauna

- Regarding the conservation status of the fauna, none of the animal species identified from the site belonged to the threatened categories identified by the International Union for Conservation of the Nature and Natural Resources (IUCN). Most of them are common and widely distributed and the range of occurrence extended to wide geographical area.

1.1.5 Recommendations

The following species of native plants can be planted in the area earmarked for green zone and also during mine closure.

SN	Trees	
	Scientific Name	Common Name
1	<i>Tabernaemontana alternifolia</i> (Recorded from the project area)	Kunnanpala

2	<i>Michelia nilagirica</i>	Vellachembakam
3	<i>Artocarpus heterophyllus</i> (Recorded from the project area)	Plavu
4	<i>Briedelia retusa</i>	Mulluvenga
5	<i>Ficus racemosa</i>	Athi
6	<i>Terminalia paniculata</i>	Maruth
7	<i>Xylia xylocarpa</i> (Recorded from the project area)	Irul
8	<i>Syzygium cumini</i>	Njaval
9	<i>Mangifera indica</i> (Recorded from the project area)	Mavu
10	<i>Holarrhena pubescens</i>	Kudagapala
11	<i>Azadirachta indica</i> Adr. Juss.	Aryaveppu
12	<i>Cananga odorata</i>	Kanangamaram
13	<i>Michelia champaca</i>	Chembakam
14	<i>Wrightia tinctoria</i> R.Br.(Recorded from the project area)	Dandappala
15	<i>Artocarpus hirsutus</i> Lam (Recorded from the project area)	Anjili
16	<i>Alstonia scholaris</i> (L.) R. Br. (Recorded from the project area)	Ezhilampala/Devil Tree
17	<i>Schleichera oleosa</i>	Poovam
18	<i>Mimusops elengi</i> L.	Elenji/ Asian bullet wood
19	<i>Grewia tiliifolia</i>	Chadachi
20	<i>Mallotus philippensis</i> (Lam.) Muell.-Arg. (Recorded from the project area)	Kapila

Shrubs		
Sl. No.	Scientific Name	Common Name
1	<i>Bambusa bamboosa</i>	Mula
2	<i>Helicteres isora</i> (Recorded from the project area)	Edampiri valampiri
3	<i>Sida rhombifolia</i> (Recorded from the project area)	Kurunthotti
4	<i>Pseudarthria viscida</i>	Muvvila
5	<i>Justicia adhatoda</i>	Aadalodakam
6	<i>Ixora coccinea</i> (Recorded from the project area)	Thechi

7	<i>Artabotrys hexapetalus</i>	Manoranjini, Madanapoo
8	<i>Melastoma malabathricum</i>	Athirani
9	<i>Mussaenda frondosa</i> L. (Recorded from the project area)	Vellila
10	<i>Artabotrys zeylanicus</i>	Manoranjini

List of Endemic plant species observed from the proposed mining area and its Natural/Commercial Propagation procedures

SN	Botanical Name	Endemism	Propagation Methods	Remarks
1	<i>Calamus hookerianus</i>			
2	<i>Tabernaemontana alternifolia</i> L.	Endemic to the Western Ghats	Seed propagation, cuttings and divisions of old rootstocks	
3	<i>Artocarpus hirsutus</i> Lam.	Endemic to Southern Western Ghats	Seed propagation, grafting	
4	<i>Naregamia alata</i>	Endemic to Peninsular India	Seed propagation	

Site specific list of Butterfly's Larval Host Plant, Alkaloid Plants and Nector Plants to be planted during Ecorestoration of the quarry to attract Butterflies

SN	Scientific Name	Larval Host plant	Alkaloid Plant	Nector Plants	Remarks
1	<i>Pachliopta hector</i>	<i>Aristolochia indica</i> , <i>A. bracteolata</i> , and <i>Thottea siliquosa</i> (Family Aristolochiaceae)			
2	<i>Pachliopta aristolochiae</i>	<i>Aristolochia bracteolata</i> <i>Aristolochia indica</i> <i>Aristolochia tagala</i> <i>Aristolochiae griffithi</i> <i>Thottea siliquosa</i>			Mud-puddling
3	<i>Papilio clytia</i>	<i>Alseodaphne semecarpifolia</i> , <i>Cinnamomum camphora</i> , <i>C. macrocarpum</i> , <i>C. malabatum</i> , <i>C. tamala</i> , <i>C. verum</i> , <i>Litsea deccanensis</i> , <i>L. glutinosa</i> , <i>Persea gamblei</i> , <i>Ocotea lancifolia</i> , <i>Sarcosperma arboretum</i> etc.			Mud-puddling

4	<i>Papilio polytes</i>	<i>Aegle marmelos, Atalantia racemosa, C. aurantiifolia, C. maxima, C. limon, C. medica, Clausena anisata, Glycosmis pentaphylla, Murraya koenigii, M. paniculata, Ravenia spectabilis, Zanthoxylum rhetsa etc.</i>		<i>Lantana, Jatropha, Ixora, and Mussaenda, Asystasia, Peristrophe, and Jasminum,</i>	Mud-puddling
5	<i>Papilio polymnestor</i>	<i>Garcinia xanthochymus, Atalantia racemosa, Atalantia wightii, Citrus maxima, Citrus limon, Glycosmis pentaphylla, Murraya koenigii, Paramignya monophylla etc.</i>			Mud-puddling
6	<i>Graphium agamemnon</i>	<i>Annona glabra, Annona muricata, Annona squamosa, Artabotrys hexapetalus, Desmos chinensis, Goniothalamus cardiopetalus, Miliusa tomentosa, Mitrephora heyneana etc.</i>			
7	<i>Troides minos</i>	<i>Aristolochia indica, Aristolochia tagala, Thottea siliquosa and Bragantia wallichii</i>		<i>Lantana, Ixora, and Mussaenda,</i>	
8	<i>Papilio demoleus</i>	<i>Cullen corylifolium, Ziziphus jujube, Acronychia pedunculata, Aegle marmelos, Chloroxylon swietenia, Citrus aurantiifolia, Citrus maxima, Citrus sinensis etc.</i>			Mud-puddling
9	<i>Eurema hecabe</i>	<i>Acaciaspp., Aeschynomene americana, Senna alata, S. tora, S. obtusifolia, Albizia procera, A. saman, Caesalpinia mimosoides, C. pulcherrima, C. sappan, Cassiaspp., C. fistula etc.</i>			
10	<i>Leptosia nina</i>	<i>Capparis baducca, Capparis spinosa, Capparis zeylanica, Crateva adansonii, Crateva religiosa</i>			
11	<i>Eurema blanda</i>	<i>Acrocarpus fraxinifolius, Albizia spp., Albizia lebbeck, Bauhinia purpurea, Caesalpinia</i>			

		<i>mimosoides, C. regia, C. sappan, Calliandra calothyrsus, Cassia fistula,</i>			
12	<i>Catopsilia pomona</i>	<i>Bauhinia racemosa, Butea monosperma, Cassia fistula, Dalbergia latifolia, Senna tora, S. siamea, Sesbania grandiflora etc.</i>			
13	<i>Tirumala septentrionis</i>	<i>Vallaris dichotoma, V. heynei</i> (Family Apocynaceae), <i>Cosmostigma racemosa</i> , and <i>Wattakaka volubilis</i> (Family Asclepiadaceae).			
14	<i>Elymnias hypermnestra</i>	<i>Areca catechu, Calamus rotang, C. pseudofoeanus, C. thwaitesii, Arenga engleri, A. pinnata, A. wightii, Caryota urens, Chamaerops humilis, Dypsis lutescens, Cocos nucifera, Elaeis guineensis, Livistona chinensis etc</i>			
15	<i>Euploea core</i>	<i>Adenium obesum, Asclepias curassavica, Carissa carandas, C. spinarum, Cascabela thevetia, Cryptolepis dubia, C. sinensis, Hemidesmus indicus, Holarrhena spp., Ichnocarpus frutescens, Nerium spp., Nerium oleander,</i>	<i>Crotalaria and Heliotropium</i>		Mud-puddling
16	<i>Neptis hylas</i>	<i>Bombax ceiba, Hevea brasiliensis, Canavalia ensiformis, Canavalia gladiata, Flemingia spp., Lathyrus spp., Mucuna purpurea, Paracalyx spp., P. scariosus, Rhynchosia spp., Vigna cylindrica, V. unguiculata, Xylia xylocarpa etc.</i>			
17	<i>Hypolimnasia bolina</i>	<i>Abutilon sp., Hibiscus sp., Arrowleaf Sida Sida rhombifolia</i> (Family Malvaceae), Common Purslane <i>Portulaca oleracea</i> (Family Portulacaceae), <i>Elatostemma cuneatum</i> , Hen's Nettle <i>Laportae interrupta</i> (Family Urticaceae).			

18	<i>Euploea sylvester</i>	<i>Hoya sp.</i> , <i>Cynanchum sp.</i> (Family Asclepiadaceae, Milkweeds), <i>Ichnocarpus frutescens</i> (Family Apocynaceae), <i>Ficus microcarpa</i> , <i>Ficus racemosa</i> (<i>F. glomerata</i>), <i>Ficus sp.</i> (Family Moraceae, Figs).			
19	<i>Tirumala limniace</i>	<i>Holarrhena pubescens</i> , <i>Asclepias curassavica</i> , <i>Calotropis gigantean</i> , <i>Calotropis procera</i> , <i>Cosmostigma cordatum</i> etc.			
20	<i>Ariadne ariadne</i>	<i>Ricinus communis</i> , Indian Stinging Nettle <i>Tragia involucrata</i> , <i>T. plukenetii</i> (Family Euphorbiaceae).			
21	<i>Ypthima baldus</i>	Plant species from Poaceae family			
22	<i>Junonia iphita</i>	<i>Barleria cristata</i> , <i>Dipteracanthus prostratus</i> , <i>Hygrophila auriculata</i> , <i>Justicia micrantha</i> , <i>J. neesii</i> , <i>Ruellia elegans</i> , <i>R. simplex</i> , <i>R. tuberosa</i> , <i>R. tweediana</i> , <i>Strobilanthes callosus</i> , <i>S. ciliata</i> , <i>Achimenes grandiflora</i>			
23	<i>Danaus genutia</i>	<i>Asclepias curassavica</i> , <i>Ceropegia sp.</i> , <i>Cynanchum sp.</i> , <i>Marsdenia roylei</i> , <i>Stephanotis sp.</i> , <i>Tylophora tenuis</i> (Family Asclepiadaceae).	<i>Crotalaria</i> , <i>Heliotropium</i> , and <i>Eupatorium</i>		
24	<i>Melanitis leda</i>	<i>Poaceae</i> , <i>Apluda</i> , <i>Bambusa</i> , <i>Brachiaria mutica</i> , <i>Coix lacrymajobi</i> , <i>Cyrtococcum</i> , <i>Digitaria</i> , <i>Eleusine Oplismenus composites</i> , <i>Oryza sativa</i> , <i>Panicum repens</i> , <i>Pennisetum glaucum</i> , <i>Pennisetum purpureum</i> , <i>Rottboellia cochinchinensis</i> , <i>Saccharum officinarum</i> , <i>Setaria barbata</i> , <i>Zea mays</i>			
25	<i>Ypthima huebneri</i>	<i>Axonopus compressus</i> , Grass spp. (Family Poaceae).			

26	<i>Mycalesis perseus</i>	<i>Poaceae, Oplismenus composites, Oryza sativa</i>			
27	<i>Parthenos sylvia</i>	<i>Zanonia indica, Tinospora sinensis, Adenia hondala</i>			
28	<i>Jamides celeno</i>	<i>Abrus precatorius, Cajanus albicans, Butea monosperma, Phaseolus adenanthus, Pongamia pinnata, Saraca asoca, Xylia xylocarpa, Heynea trijuga, Trichilia hirta, T. trijuga, Elettaria cardamomum</i>			
29	<i>Prosotas nora</i>	<i>Mallotus philippensis, Acacia caesia, Acacia catechu, Acacia torta, Mimosa invisa, Pithecellobium dulce, Allophylus cobbe</i>			
30	<i>Talicaa nyseus</i>	<i>Kalanchoe laciniata, Kalanchoe calycinum, K. pinnata, Bryophyllum delagoense, Bryophyllum pinnatum</i>			
31	<i>Castalius rosimon</i>	<i>Ziziphus jujuba, Ziziphus oenopolia, Ziziphus rugosa, Ziziphus xylopyrus</i>			
32	<i>Chilades pandava</i>	<i>Cycas circinalis, Cycas revoluta (Family Cycadaceae), Acacia spp., Xylia xylocarpa (Mimosaceae).</i>			
33	<i>Rathinda amor</i>	<i>Mangifera indica, Meiogyne pannosa, Calophyllum, Hopea Blachia, Croton, Barringtonia acutangula, Careya arborea Loranthus, Eugenia roxburghii Ixora brachiata, Schleicheria Quassia indica</i>			
34	<i>Zizina otis</i>	<i>Amaranthus viridis, Alysicarpus vaginalis, Desmodium heterophyllum, Desmodium triflorum, Sesbania bispinosa, Zornia diphylla, Zornia gibbosa, Zornia reticulata, Tribulus terrestris</i>			

35	<i>Udaspes folus</i>	Species of ginger and turmeric including <i>Curcuma aromatica</i> , <i>C. decipiens</i> , <i>C. pseudomontana</i> , <i>Hedychium</i> spp., <i>Zingiber</i> sp. (Family Zingiberaceae). Also on Grasses.			
36	<i>Sarangesa dasahara</i>	<i>Asystasia</i> spp., <i>Blepharis asperrima</i> , <i>Lepidagathis cuspidata</i>			
37	<i>Tagiades gana</i>	<i>Dioscorea alata</i> , <i>Dioscorea oppositifolia</i> , <i>Dioscorea wallichii</i>			

Some butterfly species reported from the proposed quarry site are performing mud-puddling activities. Thus during ecorestoration process prepare a muddy spot and a wet patch inside the minedout area to help mud puddling butterfly species. Butterflies (especially males of many species) will visit such damp and muddy places to get their daily dose of water, minerals and various chemicals needed for their physiological needs. This is known as 'mud-puddling'.

List of Invasive Species observed from the Project area

Sl. No.	Botanical Name	Vernacular Name	Type
1	<i>Lantana camara</i> L.	Kongini	Shrub
2	<i>Clidemia hirta</i>		Shrub
3	<i>Hyptis suaveolens</i> (L.) Poit.	Nattapoochedi	Shrub
4	<i>Chromolaena odorata</i>	Communist-pacha	Shrub
5	<i>Senna tora</i> (L.) Roxb.	Thakara	Herb
6	<i>Colocasia esculenta</i> (L.) Schott	Chembu	Herb
7	<i>Cheilocostus speciosus</i>	Channakoova	Herb
8	<i>Cyathula prostrata</i> (L.) Blume	Cherukadaladi	Herb
9	<i>Mikania micrantha</i> Kunth	Vayara	Climber
10	<i>Pueraria phaseoloides</i> (Roxb.) Benth.	Thotta-payar	Climber

10 KM. BUFFER ZONE

MAJOR LAND USE OF THE AREA IDENTIFIED

- 1) Mixed Crop System
- 2) Rubber plantaion
- 3) River/Stream/Canals (Iravazhinjipuzha, Chaliyar)
- 4) Semi-Evergren Forest
- 5) Decidious Forest
- 6) Riparian Forest
- 7) Grassland
- 8) Arecanut Fields
- 9) Cocunut Fields
- 10) Bananana Fields
- 11) Barren Rocky Area
- 12) Urban land

GENERAL VIEWS























FINDINGS – FLORA

The Site has **603 species of plants**. It consists of:

Trees	:	201 species
Shrubs	:	112 species
Herbs	:	188 species
Climbers	:	86 species
Ferns	:	16 species

LIST OF TREES

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Status
1	<i>Garcinia Mangostana</i>	Mangosteen	Clusiaceae	Cultivated.	Native of Malaysian Region	
2	Plumeria alba		Apocynaceae	Grown as ornamental	Forested areas	
3	<i>Talipariti tiliaceum</i>	Poopparuthi	Malvaceae	Tropical and subtropical forests and coastal forests.	Pantropics	
4	<i>Bombax insigne</i>	Kallilavu	Malvaceae	Rocky areas in evergreen, semi-evergreen and moist deciduous forests	India and Myanmar	
5	<i>Firmiana colorata</i>	Malamparathy	Malvaceae	Semi-evergreen and moist deciduous forests	Indo-Malesia and China	
6	<i>Cipadessa baccifera</i>	Kaippanarangaai	Meliaceae	Moist deciduous and semi-evergreen forests, also in sacred grooves	Indo-Malesia	
7	<i>Melia azedarach</i>	Malaveppu	Meliaceae	Cultivated		
8	<i>Swietenia macrophylla</i>	Manthagani, Mahogani	Meliaceae	Cultivated as avenue tree, also raised in plantations.	Native of Central America	
9	<i>Lophopentalum wightianum</i>	Venkotta	Celstraceae	Evergreen forests and sacred groves	Indo-Malesia	

10	<i>Alastonia venenata</i>	Theepala	Apocynaceae	Moist deciduous and dry deciduous forests, often in forests clearings	Peninsular India	
11	<i>Araucaria columnaris</i>	Christmas Tree	Araucariaceae	An introduced evergreen tree	Native to New Caledonia	
12	<i>Platyclusus orientalis</i>	Oriental Thuja	Cupressaceae			
13	<i>Persea americana</i>	Avacado	Lauraceae	Cultivated	Native of Tropical America	
14	<i>Callistemon citrinus</i> (Curtis) Skeels.	Bottle brush	Myrtaceae	Cultivated as ornamental	Native of Australia	Exotic
15	<i>Cassia fistula</i> L.	Kanikkonna	Caesalpinaceae	Found in deciduous forests from plains to 1400m. often planted along the roadsides.	Indo-Malesia	
16	<i>Diospyros candolleana</i>	Kari, Karimaram	Ebenaceae	Evergreen, semi-evergreen and moist deciduous forests	Peninsular India	Endemic to Peninsular India
17	<i>Litsea quinqueflora</i> (Dennst.) Suresh.		Lauraceae	Evergreen and deciduous forests	Southern Western Ghats	Endemic to the Western Ghats
18	<i>Adenanthera pavonina</i> L.	Manjadi	Leguminosae	Planted as ornamental tree	Sri Lanka, Himalayas, Myanmar, Thailand, Malaysia and China	
19	<i>Erythrina variegata</i> L.	Mullumuru	Leguminosae	Dry deciduous forests, widely grown as pepper stand and for fencing	Indo-Malesia, China and Africa	
20	<i>Pongamia pinnata</i> (L.) Pierre	Ungu	Leguminosae	Deciduous and mangrove forests, also planted as avenue tree	Indo-Malesia	
21	<i>Mitragyna parvifolia</i>	Poochakadam bu,	Rubiaceae	Moist deciduous forests	Indo-Pacific	

		Rosekadambu				
22	<i>Caesalpinia coriaria</i>	Dividivi	Fabaceae			
23	<i>Saraca asoca</i>	Ashokam	Fabaceae	Evergreen forests. Also grown as ornamental.		
24	<i>Streblus asper</i>	Paravamaram	Moraceae	Moist and dry deciduous forests	Indo-Pacific	
25	<i>Terminalia paniculata</i> Roth	Maruth	Combretaceae	Moist and dry deciduous forests, also in the plains	Peninsular India	Endemic to Peninsular India
26	<i>Melicope lunu-ankenda</i> (Gaertn.) Hartley	Kaneli	Rutaceae	Evergreen, semi-evergreen and moist deciduous forests		
27	<i>Dillenia pentagyna</i>	Valapunna, Vazhapunna	Dilleniaceae	Deciduous forests altitude up to 3000 ft.	Indo-Malesia	
28	<i>Swietenia mahagoni</i> (L.) Jacq.	Mahagony	Meliaceae	Grown as avenue tree		
29	<i>Lagerstroemia speciosa</i> (L.) Pers.	Poomaruthu/ Manimaruthu	Lythraceae	Semi evergreen and Evergreen Forest mostly along banks of streams also planted as an avenue tree	Indo-Malesia	
30	<i>Terminalia elliptica</i>	Karimaruthu	Combretaceae	Moist and dry deciduous forests	Dry Deciduous Forests	
31	<i>Macaranga peltata</i> (Roxb.) Müll.Arg.	Vatta	Euphorbiaceae	Moist deciduous and secondary forests, also in the plains	India, Sri Lanka and Andamans	
32	<i>Albizia saman</i> (Jacq.) Merr.	Mazhamaram/rain tree	Leguminosae	Cultivated as avenue tree	Native of Central and South America	
33	<i>Gliricidia sepium</i> (Jacq.) Walp.	Seemakonna	Leguminosae	Cultivated in fields and along fences	Native of South America; introduced and widely grown in India	

34	<i>Ficus religiosa</i> L.	Arayal	Moraceae	Plains from the coast up to 1200m. Often planted around temples		
35	<i>Holarrhena pubescens</i>	Kutakappaala	Apocynaceae	Moist deciduous and dry deciduous forests, also in the plains	Indo-Malesia	
36	<i>Bauhinia malabarica</i>	Vellamantharam	Fabaceae	Deciduous forests	Indo-Malesia	
37	<i>Hopea ponga</i>	Illapongu, Pongu	Dipterocarpaceae	Southern Western Ghats	Peninsular India.	
38	<i>Psidium guajava</i> L.	Pera	Myrtaceae	Cultivated	Originally from Tropical America; now naturalised in the tropics	Exotic
39	<i>Vateria indica</i> L.	Velutta Kunturukkam /Vellapayin	Dipterocarpaceae	Evergreen and semi-evergreen forests, also in the plains	Western Ghats	Endemic to the Western Ghats
40	<i>Phyllanthus emblica</i>	Nelli	Phyllanthaceae	Dry and moist deciduous forests, also cultivated in the plains	Throughout the tropics	
41	<i>Peltophorum pterocarpum</i>	Copperpod	Fabaceae	Planted as avenue tree.	Native of Australia	
42	<i>Baccaurea courtallensis</i>	Mootikaya, Mootilpazham,	Phyllanthaceae	Evergreen and semi-evergreen forests	Peninsular India	Endemic to Peninsular India
43	<i>Gmelina arborea</i>	Kumbil	Lamiaceae	Deciduous forests altitude up to 4000 ft.	Indo-Malesia	
44	<i>Cinnamomum verum</i>	Karuva	Lauraceae	Evergreen and riparian forests, also cultivated	South West India and Sri Lanka	
45	<i>Artocarpus hirsutus</i> Lam.	Anjili	Moraceae	Semi-evergreen and moist deciduous forests, also in the plains	Southern Western Ghats	Endemic to the Western Ghats
46	<i>Albizia procera</i>	Kottavaga,	Fabaceae	Moist deciduous	Indo-Malesia	

		Vellavaka		forests and also in the plains	and China	
47	<i>Carica papaya</i> L.	Papaya	Caricaceae	Cultivated	Native of Tropical America	Exotic
48	<i>Tabernaemontana alternifolia</i> L.	Kunnanpala	Apocynaceae	Along margin of the evergreen forests and common in moist deciduous forest, up to 850 m.	Western Ghats	Endemic to the Western Ghats
49	<i>Diospyros malabarica</i>	Panachi, Vananji	Ebenaceae	Evergreen forests	Indo-Pacific	
50	<i>Garcinia wightii</i>	Aattukaruka	Clusiaceae	Riverine forests	Southern Western Ghats	Endemic to Southern Western Ghats
51	<i>Schleichera oleosa</i>	Poovam	Sapindaceae	Semi evergreen and moist deciduous forests	Indo-Pacific	
52	<i>Dysoxylum malabaricum</i>	Akil, Purippa	Meliaceae	Evergreen forests	Southern Western Ghats	Endemic to Southern Western Ghats
53	<i>Wrightia tinctoria</i> R.Br.	Dandappala	Apocynaceae	Moist and dry deciduous forests, also in the plains	India, Myanmar and Timor	
54	<i>Anacardium occidentale</i> L.	Kasumavu	Anacardiaceae	Cultivated	Native of South America; now widely cultivated in Asia and Africa	Exotic
55	<i>Mallotus tetraococcus</i>	Porivatta,	Euphorbiaceae	Evergreen forests	Indo-Pacific	
56	<i>Salix tetrasperma</i>	Puzhapanji, Vachi	Salicaceae	Riverbanks	Indo-Pacific and Holarctic	
57	<i>Theobroma cacao</i>	Cocoa	Malvaceae	Widely cultivated in the tropics.	Native of Tropical America	

58	<i>Zanthoxylum rhetsa</i> (Roxb.) DC.	Kothumurikku / Mullilam/Murikku	Rutaceae	Evergreen and moist deciduous forests, also in the plains	Indo-Malesia	
59	<i>Sterculia urens</i> Roxb.	Thondi	Sterculiaceae	Moist and dry deciduous forests	Indo-Malesia	
60	<i>Tectona grandis</i> L.f.	Thekku	Verbenaceae	Moist deciduous forests, also raised in plantations	South and South East Asia	
61	<i>Morinda coreia</i> Buch.-Ham.	Manjanathi	Rubiaceae	Moist and dry deciduous forests, also in the plains		
62	<i>Memecylon malabaricum</i> Cogn.	Kaikka-thetti, Koovachekki	Melastomataceae	Semi-evergreen forest, also in the plains	Western Ghats	Endemic to Southern Western Ghats
63	<i>Alstonia scholaris</i> (L.) R. Br.	Ezhilampala/ Devil Tree	Apocynaceae	Moist deciduous forests and sacred groves, also in the plains	South and South East Asia to Australia	
64	<i>Cocos nucifera</i> L.	Thengu / Coconut	Arecaceae	Cultivated	Cultivated throughout the tropics	
65	<i>Caryota urens</i> L.	Choonda/ Choondappana	Arecaceae	Evergreen forests, also in the plains	Indo-Malaysia	
66	<i>Areca catechu</i> L.	Kavung, Pakku	Arecaceae	Cultivated	Cultivated from India to the Solomon Islands and less commonly in Africa and Tropical America	
67	<i>Pajanelia longifolia</i> (Willd.) K.Schum	Payyani/Palakapayyani,	Bignoniaceae	Moist deciduous and semi-evergreen forests, also in the plains	India and Myanmar	Exotic
68	<i>Holigarna grahamii</i>	Cheru	Anacardiaceae	Evergreen forests	Western Ghats	Endemic to Western

						Ghats,.
69	<i>Aegle marmelos</i>	Koovalam	Rutaceae	Cultivated	India and Sri Lanka; widely cultivated in South East Asia, Malesia, Tropical Africa and the United States	
70	<i>Carallia brachiata</i> (Lour.) Merrill	Varangu	Rhizophoraceae	Subcanopy trees in evergreen forests up to 1200 m.	Indomalaysia and Australia; in the Western_Ghats- throughout.	Exotic
71	<i>Moringa oleifera</i> Lam.	Muringai	Moringaceae	Indigenous to Sub-Himalayan tracts		
72	<i>Acacia chundra</i>	Karingali, Kannali	Fabaceae	Dry deciduous forests	Peninsular India, Sri Lanka and Myanmar	
73	<i>Pterocarpus marsupium</i>	Karavenga, Venna, Venga	Fabaceae	Common on hill slopes even in dry and fully exposed areas above 750-1400m.	India and Sri Lanka	
74	<i>Bischofia javanica</i>	Cholavenga, Chorakkali,	Phyllanthaceae	Evergreen and semi-evergreen forests	Indo-Malesia to Pacific Islands	
75	<i>Ficus tsjahela</i> Burm.f.	Karal/Kara/Chela	Moraceae	Moist deciduous forests, also in the plains; often epiphytic and later becoming independent	Peninsular India and Sri Lanka	
76	<i>Spondias pinnata</i> (L. f.) Kurz	Ampazham/ Indian Hog Plum	Anacardiaceae	Occasional in evergreen to moist deciduous forests.	Indo-Malaysia	
77	<i>Humboldtia vahliana</i>	Kurappunna, Korathi	Fabaceae	Riverbanks	Southern Western Ghats	Endemic to Southern Western Ghats

78	<i>Persea macrantha</i> (Nees) Kosterm.	Kulir Mavu	Lauraceae	Evergreen, semi-evergreen and moist deciduous forests, also in sacred groves	Peninsular India and Sri Lanka	
79	<i>Barringtonia racemosa</i> (L.) Spreng.	Samudrachampa	Lecythidaceae	Along banks of backwaters and mangrove forests	Indo-Malesia to Polynesia	
80	<i>Manilkara zapota</i> (L.) P.Royen.	Sappota	Sapotaceae	Cultivated	Native of Tropical America	Exotic
81	<i>Butea monosperma</i>	Plasu	Fabaceae	Dry and moist deciduous forests	Indo-Pacific	
82	<i>Simarouba glauca</i>	Lakshmi taru	Simaroubaceae	Cultivated	Native to Florida in the United States, southern Florida, South America, and the Lesser Antilles	
83	<i>Syzygium aqueum</i> (Burm. f.) Alston	Chamba	Myrtaceae	Cultivated	Malaysia	
84	<i>Trema orientalis</i> (L.) Bl.	Pottaama	Ulmaceae	Dry and moist deciduous forests, also in the plains		
85	<i>Bauhinia tomentosa</i> L.	Manjamandaram	Caesalpinaceae	Cultivated as ornamental plant	Native of South east Asia	Exotic
86	<i>Barringtonia acutangula</i>	Aattupezhu	Lecythidaceae	River margins and backwaters	Indo-Pacific and Australian	
87	<i>Syzygium cumini</i> (L.) Skeels	Indian Blackberry	Myrtaceae	Evergreen forests, also in the plains	Indian subcontinent, south east Asia, Australia.	
88	<i>Pouteria campechiana</i> (Kunth) Baehni	Egg fruit	Sapotaceae	Cultivated in homesteads.	Native of Central & Tropical America	
89	<i>Alangium salviifolium</i> (L.f.) Wangerin.	Ankolam	Cornaceae	Common in moist deciduous forests upto 900m.	Africa, Sri Lanka, India to East and South	Medicinal

					east Asia.	
90	<i>Aporosa cardiosperma</i> (Gaertn.) Merr.	Ponvetti/Vetti	Phyllanthaceae	Usually in open evergreen to semi-evergreen forests	Peninsular India and Sri Lanka	
91	<i>Glochidion zeylanicum</i> (Gaertn.) A.Juss.	Pannimutti/Neervetti	Phyllanthaceae	Evergreen and semi-evergreen forests, also in the plains	Indo-Malesia	
92	<i>Cinnamomum malabatum</i> (Burm.f.) J.Presl.	Idana	Lauraceae	Evergreen and semi-evergreen forests, also in the plains	Southern Western Ghats	Endemic to Southern Western Ghats
93	<i>Peltophorum pterocarpum</i> (DC.) Baker ex Heyne.	Yellow Flame Tree	Caesalpinaceae	Planted as avenue tree	Native of Australia	Exotic
94	<i>Syzygium jambos</i>	Malakkacampa/Panineerchamba	Myrtaceae	Western Ghats & Eastern Ghats, Cultivated,	Native of Malaysian Region	
95	<i>Azadirachta indica</i> Adr. Juss.	AryaVeppu	Meliaceae	Dry deciduous forests, also widely planted	Indo-Malesia	
96	<i>Annona squamosa</i> L.	Seethapazham	Annonaceae	Cultivated	Native of Central America and West Indies	Exotic
97	<i>Artocarpus heterophyllus</i> Lam.	Plavu	Moraceae	Evergreen and semi-evergreen forests, also widely cultivated	Widely cultivated in the tropics, origin is probably South India	
98	<i>Citrus maxima</i> (Burm.) Osbeck	Bamblimoos	Rutaceae	Cultivated	Native of South east Asia	
99	<i>Citharexylum spinosum</i>	Parijatham	Verbenaceae	Cultivated	South American	
100	<i>Caesalpinia sappan</i> L.	Chappangam	Leguminosae	Cultivated		
101	<i>Leea indica</i> (Burm.f.) Merr.	Erattayani	Leeaceae	Degraded semi-evergreen and evergreen forests,	Indo-Malesia, China and Australia	

				also in the plains		
102	<i>Xylia xylocarpa</i> (Roxb.)Taub.	Irul	Mimosaceae	Moist deciduous forests, also in the plains	Indo-Malesia	
103	<i>Bridelia retusa</i> (L.) Spreng.	Mulluvenga	Euphorbiaceae	Evergreen to Deciduous Forests	Indo-Malaya	
104	<i>Averrhoa bilimbi</i>	Irumbanpuli	Oxalidaceae	Cultivated. Native of Malaysia		
105	<i>Ficus tinctoria</i>	Ithimottu	Moraceae	Moist deciduous forests	Indo-Pacific	
106	<i>Sterculia guttata</i>	Kavalam	Malvaceae	Semi evergreen and moist deciduous forests	Indo-Pacific	
107	<i>Casuarina equisetifolia</i> L.	Choolamaram	Casuarinaceae	Cultivated	Native of Malaysian Region	
108	<i>Lagerstroemia microcarpa</i>	Vellilavu, Venthekku	Lythraceae	Moist deciduous forests	Western Ghats	Endemic to Western Ghats
109	<i>Xanthophyllum arnottianum</i>	Mottal	Polygalaceae	Evergreen and semi evergreen forests	Western Ghats	Endemic to Western Ghats
110	<i>Ficus hispida</i> L.f.	Erumanakku/ Parakam/ Thonditherakam	Moraceae	Moist deciduous and semi-evergreen forests, also in the plains	Indo-Malesia to Australia	
111	<i>Acacia auriculiformis</i> Benth.	Acacia	Leguminosae	Cultivated	Native of Tropical Australia	Exotic
112	<i>Spathodea campanulata</i>	Sphaathhoodiya	Bignoniaceae	Plains to High Altitude, Cultivated,	Native of Tropical Africa	
113	<i>Lanea coromandelica</i> (Houtt.)Merr.	Uthi/ Karayam	Anacardiaceae	Deciduous forest, also in the plains	Indo- Malaysia and China	
114	<i>Muntingia calabura</i> L.	Pancharappazham/ Bird's Cherry	Muntingiaceae	Cultivated, Ornamental	Native of Tropical America and West Indies	Exotic
115	<i>Terminalia catappa</i> L.	Badam	Combretaceae	Plains, Cultivated	Malesia to North Australia	

					and Polynesia, Commonly planted in the tropics	
116	<i>Murraya koenigii (L.) Sprengel</i>	Kariveppu	Rutaceae	Found in deciduous forests from plains to 1000m, often planted in the home gardens	Indo-Malesia and China	
117	<i>Artocarpus incisa L.f.</i>	Kadapilavu/Se emaplav18u	Moraceae	Cultivated for edible fruits	Native of New guinea	
118	<i>Morus alba</i>	Mulbari	Moraceae	Cultivated	Indo-Pacific	
119	<i>Ailanthus excelsa Roxb.</i>	Pongilam/Tre e Of Heaven	Simaroubac eae	Planted in the plains	Indo-Malesia	
120	<i>Quassia indica (Gaertn.) Nooteb.</i>	Karinjotta/Njo tta	Simaroubac eae	Moist deciduous forests	India, Myanmar and Sri Lanka	
121	<i>Ochreinauclea missionis</i>	Aattuvanchi	Rubiaceae	Riverine forests	Southern Western Ghats	Endemic to Souther n Western Ghats
122	<i>Ficus exasperata Vahl.</i>	Parakam	Moraceae	Moist deciduous forests, also in the plains	East Africa, Arabia, India and Sri Lanka	
123	<i>Polyalthia longifolia (Sonn.) Thwaites</i>	Arnanamaram	Annonaceae	Grown as ornamental tree	Native of Sri Lanka: introduced to many tropical countries	Exotic
124	<i>Tamarindus indica L.</i>	Valampuli	Leguminosa e	Cultivated	Native of Tropical Africa; introduced and widely grown in India and other parts of tropics	
125	<i>Bixa orellana L.</i>	Kurangu Mylanchi	Bixaceae	Grown as an ornamental tree	Native to South America.	Exotic
126	<i>Bombax ceiba L.</i>	Elavu	Bombacace	Moist deciduous	Tropical Asia	

			ae	and semi-evergreen forests, also in the plains	and New Guinea	
127	<i>Sapindus trifoliatus</i> L.	Soapinkaimaram	Sapindaceae	Semi-evergreen and moist deciduous forests, also in the plains	South Asia	
128	<i>Chrysophyllum cainito</i> L.	Star apple	Sapotaceae	Cultivated	Native of Tropical America	Exotic
129	<i>Mimusops elengi</i> L.	Elenji/ Asian bullet wood	Sapotaceae	Semi evergreen and evergreen forest, also grown in homestead	Indo-Malaysia	
130	<i>Garcinia gummi-gutta</i> (L.) Robs.	Kodampuli	Clusiaceae	Evergreen forests, along stream banks, also cultivated	South India and Sri Lanka	
131	<i>Streblus asper</i> Lour.	Paruvamaram	Moraceae	Moist and dry deciduous forests, also in the plains	India, China and Malesia	
132	<i>Syzygium caryophyllatum</i> (L.) Alston	Njara	Myrtaceae	Evergreen and semi-evergreen forests, also in the plains	Western Ghats and Sri Lanka	
133	<i>Flacourtia indica</i> (Burm. f.) Merr.	Vayankkaitha	Flacourtiaceae	Deciduous forests, also in the plains	Paleotropics	
134	<i>Hevea brasiliensis</i> (Willd. ex Juss.) Muell.-Arg.	Rubber	Euphorbiaceae	Cultivated	Native of Tropical America	Exotic
135	<i>Acacia mangium</i> Wild	Mangium	Leguminosae	Cultivated	Australia	Exotic
136	<i>Mangifera indica</i> L.	Mavu	Anacardiaceae	Evergreen and semi-evergreen forests and also widely cultivated	Indo-Malaysia	
137	<i>Diospyros buxifolia</i>	Elichevian, Elichuzhi, Kattuthuvara	Ebenaceae	Canopy trees in evergreen to semi-evergreen forests up to 900 m.	Indo-Malesia	
138	<i>Mitragyna</i>	Kadambu,	Rubiaceae	Moist deciduous	Indo-Malesia	

	<i>parvifolia</i>	Neerkadambu		forests		
139	<i>Lawsonia inermis</i>	Mailanji	Lythraceae	Plains and lower hills, often cultivated.	Central Asia and India.	
140	<i>Pterygota alata</i>	Kavalam	Malvaceae	Evergreen forests	South Asia and Myanmar	
141	<i>Memecylon umbellatum</i> Burm.f.	Kassavu	Melastomataceae	Semi-evergreen, shola and moist deciduous forests, also in the plains	Peninsular India and Sri Lanka	
142	<i>Hydnocarpus alpina</i>	Aattuchankala	Achariaceae	Evergreen and semi evergreen forests	Indo-Pacific	
143	<i>Calophyllum calaba</i>	Aattupunna,	Calophyllaceae	Evergreen and semi evergreen forests	Western Ghats	Endemic to Western Ghats
144	<i>Morinda citrifolia</i> L.	Mannapavatta	Rubiaceae	Waste places and mangrove forests		
145	<i>Nephelium lappaceum</i>	Rambootan	Sapindaceae	Cultivated	Southeast Asia	
146	<i>Mallotus nudiflorus</i>	Malakumbil, Naikumbil	Euphorbiaceae	Riverbanks	Indo-Pacific	
147	<i>Oroxylum indicum</i> (L.) Kurz	Palakapayyani /Vellapathiri	Bignoniaceae	Moist deciduous forests, also in the plains	South India and Sri Lanka	
148	<i>Delonix regia</i> (Hook.) Raf.	Gulmohar	Caesalpinaceae	Planted as gardens and along roadsides	Native of Madagascar; now cultivated throughout the tropics	
149	<i>Annona muricata</i>	Mullatha	Annonaceae	Cultivated	Native to tropical America cultivated in India.	Exotic
150	<i>Annona reticulata</i>	Atha	Annonaceae	Cultivated	Native of W. Indies	Exotic
151	<i>Adina cordifolia</i>	Manjakadabe	Rubiaceae	Moist deciduous forests, also in the plains		
152	<i>Plumeria rubra</i>	Arali	Apocynaceae	Cultivated	Native of	

	L.		e		Tropical America	
153	<i>Stereospermum colais var. colais</i>	Pathiri, Poopathiri,	Bignoniaceae	Common in moist deciduous forests and occasional in openings or margins of evergreen forests, up to 1200 m.	India, Myanmar, Sri Lanka	
154	<i>Sesbania grandiflora</i>	Akatti	Fabaceae	Along marshes, wet places		
155	<i>Senna siamea</i>	Manjakonna	Fabaceae	Cultivated	Native to tropical South America, South East Asia	
156	<i>Albizia chinensis</i>	Mottavaka, Vaaka, Ponthamvaka	Fabaceae	Evergreen and deciduous forests, also in the plains	Indo-Malesia and South China	
157	<i>Albizia odoratissima</i>	Nellivaga, Karinthakara, Kunnivaka	Fabaceae	Deciduous forests, also in the plains	Indo-Malesia	
158	<i>Pithecellobium dulce</i>	Kodukkapuli	Fabaceae	Cultivated	Native of tropical America, widely cultivated in the tropics.	
159	<i>Eucalyptus tereticornis</i>	Yukkali	Myrtaceae	Cultivated	Native of Australia	
160	<i>Zyzygium malaccensis</i>	Malay Apple	Myrtaceae			
161	<i>Tarenna asiatica</i>	Kuppipoovu	Rubiaceae	Semi-evergreen, moist deciduous and shola forests, also in the plains	Indo-Malesia	
162	<i>Dalbergia latifolia</i>	Eeti	Fabaceae	Dry and moist deciduous forests, also in the plains	Indo-Malesia	
163	<i>Leucaena leucocephala</i>	Subaabul	Fabaceae			
164	<i>Albizia lebbeck</i> (L.) Benth.	Nenmenivaka	Mimosaceae	Deciduous forests, also in the plains	Indo-Malesia and South China	

165	<i>Crataeva magna</i>	Neermathalam	Capparaceae	Riverbanks	Indo-Pacific and Holarctic	
166	<i>Citrus limon</i>	Odichukuthin aregam	Rutaceae	Cultivated	Southeast Asia	
167	<i>Citrus medica</i>	Curry narenga	Rutaceae	In open forests, road-sides, cultivated to naturalized; 300-800 m; frequent.	India, Nepal and Bhutan.	
168	<i>Citrus sinensis</i>	Orange	Rutaceae			
169	<i>Hopea parviflora</i>	Irumbagam, Iripu, Kambagam, Thambagam, Urippu	Dipterocarpaceae	Southern Western Ghats	Endemic to the Western Ghats- South and Central Sahyadris.	
170	<i>Murraya paniculata</i>	Maramulla	Rutaceae	Evergreen and semi-evergreen forests, also grown in the plains		
171	<i>Ficus racemosa</i> L.	Aththi	Moraceae	Semi-evergreen and deciduous forests, also in the plains	Indo-Malesia to Australia	
172	<i>Dysoxylum beddomei</i>	Akil, Adanta	Meliaceae	Evergreen forests	Southern Western Ghats	Endemic to the southern Western Ghats
173	<i>Ficus benghalensis</i> L.	Banyan Tree/Aalmaram	Moraceae	Found in all kind of forests, now widely planted in the tropics	Indian subcontinent; widely grown as avenue tree	
174	<i>Albizia chinensis</i>	Mottavaka, Pottavaka	Fabaceae	Evergreen and deciduous forests	Indo-Pacific and Holarctic	
175	<i>Mallotus philippensis</i> (Lam.) Muell.-Arg.	Kapila	Euphorbiaceae	Semi-evergreen, moist deciduous, evergreen and dry deciduous forests, also in the plains	Indo-Malesia and Australia	
176	<i>Terminalia bellerica</i>	Thani	Combretaceae	Hills 900-1400m. Indian		

				subcontinent.		
177	<i>Vitex altissima</i> L.f.	Myila, Mylellu	Lamiaceae	Found along the river banks and deciduous forests above 600m.		
178	<i>Pavetta indica</i> L.	Pavetta	Rubiaceae	Banks of rivers and rocky laterite slopes		
179	<i>Ricinus communis</i> L.	Aavannakku/ Chittavanakku	Euphorbiaceae	Cultivated, also runs wild	Native of Tropical Africa; now cultivated throughout tropics	Exotic
180	<i>Elaeocarpus serratus</i>	Valiya karai	Elaeocarpaceae	Subcanopy tree in evergreen to semi-evergreen forests up to 1600 m.	Indomalaysia; in the Western Ghats- South and Central Sahyadris	
181	<i>Elaeocarpus tuberculatus</i>	Kara	Elaeocarpaceae	Along banks of streams in evergreen and shola forests	Indo-Malesia	
182	<i>Erythroxylum monogynum</i>	Vella Devadaram	Erythroxylaceae	Dry deciduous forests	India and Sri Lanka	
183	<i>Averrhoa carambola</i>	Chaturappuli	Oxalidaceae	Cultivated, sometimes escaping to roadsides and secondary open forests		
184	<i>Aglaia elaeagnoidea</i>	Punyava	Meliaceae	Evergreen forests, also in sacred groves in the plains	Indo-Malesia to Pacific Islands	
185	<i>Careya arborea</i> Roxb.	Pezhu	Lecythidaceae	Dry Deciduous to Moist Deciduous Forests	Tropical Asia	
186	<i>Sapindus trifoliata</i>	Pasakotta, Chavakai	Sapindaceae	Semi-evergreen and moist deciduous forests, also in the plains		
187	<i>Sterculia balanghas</i>	Pavizhathondi, Narthondi	Sterculiaceae	Moist deciduous forests, also sacred groves in	Indo-Malesia	

				the plains		
188	<i>Corypha umbraculifera</i>	Kodappana, Thalippana	Arecaceae	Cultivated	Indo-Pacific	
189	<i>Atalantia recemosa</i>	Kattunaragam, Malanaragam	Rutaceae	Undergrowth in evergreen forests up to 1000 m.	Peninsular India and Sri Lanka	
190	<i>Citrus aurantium</i>	Madhuranarakam	Rutaceae	Cultivated in India	Native of China and Indonesia	
191	<i>Cananga odorata</i>	Kattuchempagam	Annonaceae	Evergreen forests		
192	<i>Michelia champaca</i>	chambakam	Magnoliaceae		Indomalaysia and China; in the Western Ghats- South and Central Sahyadris.	
193	<i>Ceiba pentandra</i> (L.) Gaertn.	Panjimaram	Bombacaceae	Cultivated	Throughout the tropics	
194	<i>Strychnos nux-vomica</i> L.	Kanjiram	Loganiaceae	Moist and dry deciduous forests, also in the plains	Indo-Malesia	
195	<i>Syzygium aromaticum</i>	Grampoo	Myrtaceae	Cultivated,	Native of Indonesia	
196	<i>Grewia tiliifolia</i>	Unnam	Malvaceae	Deciduous forests	Tropical Africa, India to Indo-China	
197	<i>Flacourtia jangomas</i>	Lovelolikka	Salicaceae	Cultivated		
198	<i>Olea dioica</i> Roxb.	Irippa	Oleaceae	Moist deciduous forests	South Asia	
199	<i>Myristica fragrans</i>	Jathi	Myristicaceae	Cultivated,	Native of East Moluccas	
200	<i>Hydnocarpus pentandra</i> (Buch.-Ham.) Oken	Marotti	Flacourtiaceae	Semi-evergreen and moist deciduous forests, also in the plains	Western Ghats	Endemic to the Western Ghats- very common in South and Central Sahyadri

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201	<i>Kleinhovia hospita</i>		Malvaceae	Grown as ornamental.	Native of Malesia	

LIST OF SHRUBS

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Status
1	<i>Hibiscus rosasinensis</i>	Chembarathy	Malvaceae	Cultivated		
2	<i>Hibiscus surattensis</i>	Pulichai	Malvaceae	Moist Deciduous Forests. Also in Plains	Pantropical	
3	<i>Malviviscus penduliflorus</i>	Pepper Hibiscus	Malvaceae	Cultivated in gardens.	Native of Tropical America	
4	<i>Sida acuta</i> Burm.f.	Kurunthotti	Malvaceae	Dry and moist deciduous forests, also in the plains	Pantropical	
5	<i>Psychotria flavida</i> Talbot.	South Indian Wild Coffee	Rubiaceae	Evergreen forests and sacred groves	Southern Western Ghats	Endemic to Southern Western Ghats
6	<i>Justicia gendarussa</i> Burm. f.	Karunochchi	Acanthaceae	Moist deciduous forests, also in the plains	Tropical Africa and Asia	Exotic
7	<i>Grewia nervosa</i> (Lour.) Panigrahi.	Cherikkotta	Malvaceae	Semi-evergreen forests, sacred groves and scrub jungles	Tropical Asia	
8	<i>Senna occidentalis</i> (L.) Link	Mattantakara	Caesalpiniaee	Along roadsides and waste lands	Native of South America; naturalised in Asia	Exotic
9	<i>Sarcostigma kleinii</i>	Erumathali, Odal	Icacinaceae	Evergreen and semi-evergreen forests, also in sacred groves	Indo-Malesia	
10	<i>Salcia fruticosa</i>	Ponkarandi,	Celestraceae	Evergreen and	Western	

		Eakanayakam	e	semi-evergreen forests, also in the sacred groves and plains	Ghats	
11	<i>Cayratia pedata</i>		Vitaceae	Forests, shrub jungles, rocky areas, roadsides		
12	<i>Cajanus scarabaeoides</i>	Kattumuthira	Fabaceae	Moist deciduous forests, also in the plains	Tropical Asia; introduced in Africa	
13	<i>Quisqualis indica</i>	Rangoon Creeper	Combretaceae	Grown in gardens,	Native of Asia	
14	<i>Fioria vitifolia</i>	Vellai Ooral	Malvaceae	Dry deciduous and semi evergreen forests	Paleotropics	
15	<i>Hibiscus mutabilis</i>	Chinappratti	Malvaceae	Cultivated	Cultivated as ornamental. Native of China	
16	<i>Ipomoea carnea ssp. fistulosa</i>	Neyveli katta	Convolvulaceae	In marshy areas along the banks of streams and paddy fields, also grown as hedge plant	Native of America; now Pantropical	Exotic
17	<i>Lantana camara</i> L.	Kongini	Verbenaceae	Most aggressive weed of disturbed ground from plains to the hills.	Native of tropical America, widely naturalised in tropics and subtropics.	Invasive Species
18	<i>Flueggea leucopyrus</i> Willd.	Cerimklaav/ Amboorippachila/ Mulpulanji	Phyllanthaceae	Dry deciduous forests	India, Sri Lanka and Myanmar	
19	<i>Epiphyllum oxypetalum</i>	Nisagandhi	Cactaceae			
20	<i>Ziziphus rugosa</i> Lam.	Kottamullu	Rhamnaceae	Common on exposed and dry slopes and forest edges	India, Sri Lanka, Bangladesh and	

				from 900-1500m. Peninsular India.	Myanmar	
21	<i>Phyllanthus reticulatus</i> Poir.	Nirnelli/Oory	Phyllanthaceae	Stream banks, lake shores and also in moist deciduous and semi-evergreen forests	Paleotropics	
22	<i>Allamanda cathartica</i> L. var. <i>nobilis</i> Bailey	Manjakolambi	Apocynaceae	Plains to High Altitude, Cultivated	Native of Tropical America	Exotic
23	<i>Breynia vitis-idaea</i> (Burm.f)	Kattuniruri	Euphorbiaceae	Semi – evergreen and moist deciduous forest, also in the plains	Indo-Malesia	
24	<i>Aerva lanata</i> (L.) A.L.Juss.	Cherula	Amaranthaceae	Common wayside weed by arable lands, fallow fields.	Widespread in the tropics and subtropics	
25	<i>Senna alata</i> (L.) Roxb.	Malamthakara/ Candle Bush	Leguminosae	Along riversides and margins of ponds	Pantropical	
26	<i>Glycosmis mauritiana</i>	Panal	Rutaceae	Evergreen forests	Indo-Pacific	
27	<i>Coffea arabica</i> L.	Kappi	Rubiaceae	Cultivated, introduced in the hilly areas of tropical countries	Native of Ethiopia	Exotic
28	<i>Canthium angustifolium</i> Roxb.	Kattakara	Rubiaceae	Moist deciduous, semi-evergreen and evergreen forests	India and Myanmar	
29	<i>Clerodendrum infortunatum</i> L.	Perivelam	Verbenaceae	Degraded forest areas and also in the plains	Indo-Malesia	
30	<i>Crotalaria pallida</i> Aiton.	Killukkichedi	Leguminosae	Found in plains, upto 1000m. Has also spread to Tropical	Native to Central and Tropical America.	Exotic

				Africa, Asia, Malaysia, Queensland.		
31	<i>Ocimum tenuiflorum</i> L.	Krishna-thulasi, Thulasi	Lamiaceae	Grown as a sacred plant, elsewhere as an escape	Paleotropic	
32	<i>Sauropus andogynus</i> (L.) Merr.	Velicheera	Euphorbiaceae	Evergreen and semievergreen forest and also grown in homesteads	Indo-Malesia	
33	<i>Clerodendrum philippinum</i>	Chendumulla	Verbenaceae	Plains to Mid Altitude, Cultivated / Naturalized,	Native of Malaysian Region	
34	<i>Solanum nigrum</i> L.	Mulaku-thakkali	Solanaceae	Very common, by riverbanks, moist places, fallow lands, arable lands.	Cosmopolitan	
35	<i>Clerodendrum paniculatum</i> L.	Krishnakireedam/Hanumankireedam	Lamiaceae	Cultivated/Naturalized	Native of Malaysian Region	
36	<i>Abutilon indicum</i> (L.) Sweet	Velluram/Ooram/Thutthi	Malvaceae	Found in wastelands	Widely distributed throughout the tropics and subtropics.	
37	<i>Solanum violaceum</i> ssp. <i>Violaceum</i> .	Cheruchunda	Solanaceae	Plains, Dry Localities/ Cleared Forests	Indo Malesia	
38	<i>Tephrosia purpurea</i> (L.) Pers.	Kozhuva	Leguminosae	Moist deciduous forests and grasslands, also in the plains	Indo-Malesia	
39	<i>Bambusa bambos</i>	Illi, Kaniyaram,	Poaceae	Deciduous forests	Indo-Pacific	
40	<i>Bambusa vulgaris</i>		Poaceae	Riparian cultivated	Indo-Pacific	
41	<i>Euphorbia nivulia</i>	Ilakkalli, Kallipala	Euphorbiaceae	Moist and dry deciduous	Indo-Pacific	

				forests		
42	<i>Hibiscus hispidissimus</i> Griff.	Matthippuli	Malvaceae	Dry and moist deciduous forests, also in the plains	Paleotropics	
43	<i>Rauvolfia serpentina</i>	Sarpagandhi, Vanduvazha	Apocynaceae	Moist deciduous forests	Indo-Pacific	
44	<i>Melastoma malabathricum</i> L.	Athirani	Melastomataceae	Stream banks and marshy areas	South East Asia	
45	<i>Osbeckia aspera</i> (L.) Blume var. <i>aspera</i> .	Kaattukkadalai	Melastomataceae	Evergreen forests and grasslands, also in the plains	Peninsular India and Sri Lanka	
46	<i>Solanum torvum</i> Sw.	Anachunda	Solanaceae	Found along the roads and wastelands from plains to 700m. Sometimes cultivated in kitchen gardens.	Throughout the tropics	
47	<i>Canthium coromandelicum</i> (Burm.f.) Alston	Madhakara	Rubiaceae	Moist and dry deciduous forests, also in sacred groves	Indo-Malesia	
48	<i>Cayratia pedata</i> (Lam.) Gagnep.	Corivalli/Tripadi	Vitaceae	Moist deciduous and semi-evergreen forests, also in sacred groves in the plains	Indo-Malesia	
49	<i>Justicia adhatoda</i> L.	Aadalodakam	Acanthaceae	In the plains, often planted	Indo-Malesia	
50	<i>Hyptis suaveolens</i> (L.) Poit.	Nattapoochedi	Lamiaceae	Degraded moist and dry deciduous forests and wastelands	Originally from America now Pantropical	Invasive Species
51	<i>Osbeckia truncata</i> D. Don ex Wt. & Arn.		Melastomataceae	Moist deciduous forests and grasslands	Western Ghats	Endemic to Southern Western Ghats

52	<i>Urena lobata</i> L.	Uram	Malvaceae	Moist deciduous forests and in the plains	Pantropical	Exotic
53	<i>Vitex negundo</i> L.	Karinochi	Verbenaceae	Grown as hedge plant, also growing wild	Indo-Malesia and China, cultivated throughout the tropics	
54	<i>Memecylon angustifolium</i>		Melastomataceae	Evergreen forests	Endemic to Southern Western Ghats	
55	<i>Hygrophila ringens</i>	Erect Hygrophila	Acanthaceae	Moist localities in the plains	Indo-Malesia	
56	<i>Thottea siliquosa</i>	Alpam, Kuttivayana	Aristolochiaceae	Evergreen and semi evergreen forests	Indo-Pacific	
57	<i>Goniothalamus thwaitesii</i>		Annonaceae	Evergreen forests	Indo-Pacific	
58	<i>Syzygium zeylanicum</i> (L.) DC.	Poocha pazham	Myrtaceae	Banks of streams in evergreen forests	Indo-Malesia	
59	<i>Helicteres isora</i>	Edampiri-valampiri	Malvaceae	Deciduous forests	Indo-Pacific and Australian	
60	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Communist-pacha	Compositae	A weed in all terrestrial habitats	Native of America; naturalised in Tropical Asia	Exotic/Invasive Species
61	<i>Barleria prionitis</i> L.	Manjakanakambaram	Acanthaceae	Dry deciduous forests and scrub jungles	Tropical Africa and Asia	
62	<i>Pseudarthria viscida</i> (L.) Wight & Arn.	Muvvila	Leguminosae	Moist deciduous forests, also in the plains	Peninsular India and Sri Lanka	
63	<i>Hibiscus rosa-sinensis</i> L. var. <i>rosa-sinensis</i>	Chembarathi	Malvaceae	Cultivated	Native of Pacific Islands	Exotic
64	<i>Syzygium caryophyllatum</i>	Cherunjara	Myrtaceae	Evergreen and semi evergreen forests	Indo-Pacific	
65	<i>Ochlandra</i>	Eetta, Karetta,	Poaceae	Evergreen and	Western	Endemic

	<i>travancorica</i>			semi evergreen forests	Ghats	to Western Ghats
66	<i>Ixora coccinea</i> L.	Thechi/ Chethi	Rubiaceae	In the plains, also grown in homesteads	Peninsular India and Sri Lanka	
67	<i>Hyptis capitata</i> Jacq.	Knobweed	Lamiaceae	Degraded forests and wastelands	Native of Tropical America; naturalised in some parts of India and Malesia	Exotic
68	<i>Girardinia diversifolia</i>	Aanachoriyanam, Aanachenthotti	Urticaceae	Evergreen, semi-evergreen, moist deciduous and shola forests, also in waste lands	Tropical Asia	
69	<i>Caesalpinia mimosodes</i> Lam.	Theemullu	Caesalpiniaaceae	Moist deciduous and degraded forests, also in the plains	Indo-Malesia	
70	<i>Abelmoschus moschatus</i>	Kasthurivenda	Malvaceae	Rocky areas in moist deciduous forests also in the plains.	South Asia to Pacific Islands	
71	<i>Jatropha curcas</i>	Kadalavanakku, Kammatti, Nanchupathal		Cultivated	South American, African and Indo-Pacific	
72	<i>Canthium parviflorum</i> Lamk.	Kandakara	Rubiaceae	Scrub forests and dry plains	Indo-Malaya	
73	<i>Calotropis gigantea</i> (L.) R. Br.	Erikku	Asclepiadaceae	Wastelands	Tropical Asia	
74	<i>Duranta erecta</i> L.	Golden grapes	Verbenaceae	Grown as hedge plant, also getting naturalised	Native from Mexico to South America and the	Exotic

					Caribbean.	
75	<i>Codiaeum variegatum</i>	Kozhivalan	Euphorbiaceae	Plains to Low Altitude, Cultivated,	Native of Malaysian Region	
76	<i>Desmodium velutinum</i>	Orila	Fabaceae	Dry and moist deciduous forests, also in the plains	South and South East Asia and Africa	
77	<i>Manihot esculenta</i> Crantz	Kappa/Maracheeni	Euphorbiaceae	Cultivated	Native of Brazil; now common throughout the tropics	Exotic
78	<i>Cassia tora</i> L.	Takara	Caesalpiniaeae	Common in plains from the coast in low lying places, river banks, fallow fields, wastelands	India to Polynesia	
79	<i>Asystasia gangetica</i> (L.) T.Anderson	Uppu-dali	Acanthaceae	Degraded forest areas and also in the plains	Peninsular India, Srilanka, Arabia, Africa	
80	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Rajamalli	Caesalpiniaeae	Cultivated as ornamental plant	Probably native in Tropical America; now widely cultivated	Exotic
81	<i>Sida rhomboidea</i>	Kurumthotti	Malvaceae	Wastelands	Peninsular India	
82	<i>Waltheria indica</i>		Malvaceae	Common at all type of habitats	Pantropical	
83	<i>Gardenia jasminoides</i>	Gandharajan	Rubiaceae	Cultivated		
84	<i>Desmodium heterocarpon</i> (L.) DC.	Nilathuvara	Leguminosae	Moist deciduous and semi-evergreen forests, also in plains	Indo-Malesia, China and Japan	
85	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Panal	Rutaceae	Semi-evergreen and moist deciduous	Indo-Malesia	

				forests, also in the plains		
86	<i>Hibiscus radiatus</i>	October Rose	Malvaceae	Cultivated	Grown as ornamental. Native of Eastern India, Bangladesh and Myanmar	
87	<i>Acalypha hispida</i>	Poochavalan	Euphorbiaceae	Plains to Mid Altitude, Cultivated,	Native of Polynesian Region	
88	<i>Clidemia hirta</i> (L.) D. Don		Melastomataceae	Degraded forest areas	Native of South America; naturalised in Paleotropics	
89	<i>Leea indica</i> (Burm.f.) Merr.	Erattayani	Leeaceae	Degraded semi-evergreen and evergreen forests, also in the plains	Indo-Malesia, China and Australia	
90	<i>Pandanus odorifer</i> (Forssk.) Kuntze.	Pookaitha/Thazhambu/Thala	Pandanaceae	Mangrove forests and sea coasts	Tropical and subtropical Asia	
91	<i>Homonoia riparia</i>	Neervanchi, Kadallari	Rhizophoraceae	Riverbanks	Indo-Pacific and Holarctic	
92	<i>Chassalia curviflora</i> (Wall.) Thwaites	Karutha-amalppori	Rubiaceae	Degraded forests	Indo-Malesia	
93	<i>Mussaenda frondosa</i> L.	Vellila	Rubiaceae	Moist deciduous and semi-evergreen forests, also in the plains	Peninsular India	
94	<i>Breynia retusa</i> (Dennst.) Alston.	Perinirouri/Aattacherukola	Euphorbiaceae	Semi-evergreen and deciduous forests, also in the plains	Sri Lanka to Indo-China	
95	<i>Osbeckia aspera</i> (L.) Blume var. <i>aspera</i> .	Kaattukkadalai	Melastomataceae	Evergreen forests and grasslands, also in the plains	Peninsular India and Sri Lanka	

96	<i>Pandanus odorifer</i> (Forssk.) Kuntze.	Pookaitha/ Thazhambu/Thala	Pandanaceae	Mangrove forests and sea coasts	Tropical and subtropical Asia	
97	<i>Agave americana</i> L.	Aanakaitha	Asparagaceae	Cultivated	Tropical America, introduced to the paleotropics	
98	<i>Barleria prionitis</i> L.	Manjakanakambaram	Acanthaceae	Dry deciduous forests and scrub jungles	Tropical Africa and Asia	
99	<i>Thyrsostachys oliveri</i>	Lathimula	Poaceae	Cultivated	E. Asia - southern China, Myanmar, Thailand.	
100	<i>Thespesia lampas</i>	Kattuparathi, Kattupoovarasu	Malvaceae	Moist deciduous forests	South and South-east Asia, Tropical East Africa	
101	<i>Tabernaemontana divaricata</i>	Nandiyarvattom	Apocynaceae	Evergreen Forests, also Cultivated		
102	<i>Psilanthus wightianus</i>	Vadamally	Rubiaceae	Dry Evergreen to Dry Deciduous Forests	Eastern Himalayas, Peninsular India and Sri Lanka	
103	<i>Pandanus canaranus</i>	Thazakaida	Pandanaceae	Along banks of streams	Peninsular India	
104	<i>Malvaviscus penduliflorus</i>	Molakuchembathy	Malvaceae	Cultivated as garden plant	Native of Tropical America	
105	<i>Lantana indica</i>	Arippu	Verbenaceae	Dry deciduous forests and grasslands	Ethiopia to South Africa, Arabian Peninsula to Indo-China	
106	<i>Jatropha curcas</i>	Kammatti, Kattuvanakku	Euphorbiaceae	Forested areas, hilly areas	Native of new world tropics, planted in other tropical areas	

107	<i>Ixora javanica</i>	Asoka-chethi, Asoka-thetti	Rubiaceae			
108	<i>Hibiscus acetosella</i>	Pulivenda	Malvaceae	Cultivated as vegetable	Native of Africa	
109	<i>Ensete superbum</i>	Kalluvazha, Malavazha	Musaceae	Moist deciduous and semi-evergreen forests	Peninsular India	
110	<i>Datura metel</i>	Ummam	Solanaceae	egraded dry & moist deciduous forests	Paleotropics	
111	<i>Capsicum annum</i>	Kappalmulaku	Solanaceae	Plains to Mid Altitude, Cultivated,	Native of Tropical America	
112	<i>Bougainvillea glabra</i>	Boganvilla	Nyctaginaceae	Plains, Cultivated,	Native of Tropical America	

LIST OF HERBS

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Status
1	<i>Microstachys chamaelea</i>	Kodiyavankku,	Euphorbiaceae	Moist and dry deciduous forests	Indo-Pacific and Australian	
2	<i>Pennisetum orientale</i> Rich.		Poaceae	Cultivated as fodder grass, often found running wild	Central Asia and North Africa	
3	<i>Merremia vitifolia</i> (Burm. f.) Hallier f.	Manja kolambivalli	Convolvulaceae	Degraded forest areas and also in the plains	Indo-China and China	Invasive species
4	<i>Cyperus distans</i>		Cyperaceae	Along banks of streams, also in wastelands and roadsides	Pantropical	
5	<i>Cyperus compressus</i>		Cyperaceae	Along banks of streams and watercourses and wastelands	Pantropical	
6	<i>Kyllinga nemoralis</i> (J.R.Forst. & G.Forst.)	Vallimuthanga/ Whitehead spikesedge	Cyperaceae	Waste places, degraded forest areas and grasslands	Pantropical	

7	<i>Limnophila indica</i>	Manganari	Plantaginaceae	Stream banks	Indo-Pacific, South American and African	
8	<i>Caladium bicolor</i> (Aiton) Vent.	Colour Chembu	Araceae	Wastelands in the plains	South America; now naturalised in the tropics	Exotic
9	<i>Leucas zeylanica</i> (L.) W.T.Aiton.	Thumba	Lamiaceae	Grasslands and savannahs, also in the plains	South and South East Asia	
10	<i>Acalypha indica</i> L.	Kuppameni/ Kuppamani	Euphorbiaceae	Common, on wastelands, in moist and shaded places, riverbanks	Indo-Malesia and Tropical Africa	
11	<i>Murdannia spirata</i> (L.) G.Brückn.	Asiatic Dewflower	Commelinaceae	Grasslands and moist places	Indo-Malesia	
12	<i>Ageratum conyzoides</i> L.	Appa	Compositae	Most abundant weed of disturbed ground and fallows, damp places and forest undergrowth.	Pantropical	Invasive Species
13	<i>Anethum graveolens</i>	Sathakuppa	Apiaceae	Cultivated	Native of Eurasia	
14	<i>Sida rhombifolia</i> L.	Kurunthotti	Malvaceae	Wastelands, also in degraded forest areas	Pantropical	
15	<i>Euphorbia thymifolia</i> L.	Chitrapala Nilappala	Euphorbiaceae	Riverbeds in moist deciduous forests, also in plains	Tropical Asia	
16	<i>Tragia involucrata</i>	Choriyanam	Euphorbiaceae	Wastelands	India and Sri Lanka	
17	<i>Leucas aspera</i> (Willd.) Link	Tumba	Lamiaceae	Deciduous forests and wastelands	Indo-Malesia	
18	<i>Alysicarpus vaginalis</i> var. <i>vaginalis</i>	Nila-orila	Leguminosae	Wastelands in the plains	Paleotropics	
19	<i>Nymphaea nouchali</i>	Ambal	Nymphaeaceae	Aquatic	Indo-Pacific and African	
20	<i>Nymphaea</i>	Neerambal,	Nymphaeaceae	Aquatic	Indo-Pacific	

	<i>pubescens</i>	Periambal	ae			
21	<i>Anaphyllum wightii</i>	Keerikkizhangu	Araceae	Evergreen and semi evergreen forests	Southern Western Ghats	Endemic to Southern Western Ghats
22	<i>Eragrostis unioloides</i> (Retz.) Nees ex Steud.	Karayampulu	Poaceae	Bunds of paddy fields, streams, banks of backwaters and waste places	South East Asia, India and Africa	
23	<i>Vigna umbellata</i> (Thunb.) Ohwi & H.Ohashi	Kattuzhunn u	Leguminosae	Semi-evergreen and moist deciduous forests	Indo-Malesia	
24	<i>Lagenandra toxicaria</i>	Neerkizhangu	Araceae	Stream banks	Western Ghats	Endemic to Western Ghats
25	<i>Limnocharis flava</i>		Alismataceae	Marshy areas	South American and Indo-Pacific	
26	<i>Globba sessiliflora</i>	Kolachanna	Zingiberaceae	Moist deciduous forests	Peninsular India	Endemic to Peninsular India
27	<i>Cyperus castaneus</i>		Cyperaceae	Stream banks	Indo-Pacific and Australian	
28	<i>Zornia diphylla</i> (L.)	Murikkotti	Leguminosae	Lateritic grassy slopes, forest plantations, also in the plains	India and Sri Lanka	
29	<i>Emilia sonchifolia</i> (L.) DC.	Muyalchevi an	compositae	Dry and moist deciduous forests, also in the plains	Tropical and Subtropical Africa and Asia	Exotic
30	<i>Oxalis corniculata</i> L.	Puliyarila	Oxalidaceae	Common in fallow fields. Optimum size in shade at higher altitudes. Found upto 500m. Widely spread.	Cosmopolitan	

31	<i>Pilea microphylla</i> (L.) Liebm.	Gunpowder Plant/Rock weed	Urticaceae	Grown as garden plant, often found as an escape	South America; now introduced into other tropical regions	Exotic
32	<i>Murdannia fadeniana</i>		Commelinaceae	Stream banks Southern Western Ghats		
33	<i>Commelina diffusa</i> Burm.	Creeping dayflower	Commelinaceae	Wastelands	Pantropical	
34	<i>Cyanotis cristata</i> (L.) D.Don.		Commelinaceae	Grasslands, degraded forest areas and wastelands	Paleotropics	
35	<i>Murdannia nudiflora</i>	Dayflower	Commelinaceae	Grasslands, also in the plains	Indo-Malesia and Africa	
36	<i>Murdannia pauciflora</i> (G.Brückn.) G.Brückn.		Commelinaceae	It is found on wet muddy soil in rice fields and marshes	Indo-Malesia	
37	<i>Sphaeranthus indicus</i>	Adakkyamaniyan	Asteraceae	Lake shores, paddy fields, etc.	Indo-Malesia, Australia and Africa	
38	<i>Cleome viscosa</i> L.	Manjavela	Cleomaceae	Weed among cultivated plants, wastelands, roadsides, etc.	Pantropical	Invasive Species
39	<i>Desmodium triflorum</i> (L.) DC.	Nilamparanda/ Cherupalladi	Leguminosae	Grasslands and moist deciduous forests, also in plains	Indo-Malesia and Australia	
40	<i>Stachytarpheta jamaicensis</i> (L.) Vahl		Verbenaceae	Dry and moist deciduous forests, also in the plains	Pantropical	
41	<i>Cheilocostus speciosus</i> (J.König) C.Specht	Channakoo va	Costaceae	Moist deciduous and semi-evergreen forests, also in the plains	Indo-Malesia	
42	<i>Panicum repens</i> L.	Creeping Panic	Poaceae	Wetlands, marshy areas of grasslands and wastelands	Tropics and subtropics of both	

					hemispheres	
43	<i>Curcuma longa</i> L.	Manjal	Zingiberaceae	Cultivated	Cultivated throughout the tropics	
44	<i>Chloris barbata</i> Sw.	Kodappullu/ Kondapullu/Mayilpullu	Poaceae	Degraded forests, wastelands and riversides	Native of Tropical Africa, spread to other tropical countries	Exotic
45	<i>Cymbopogon flexuosus</i> (Nees ex Steudel) J. F. Watson		Poaceae	Deciduous forests and grasslands, also in the plains	India and South East Asia	
46	<i>Naregamia alata</i> Wight & Arn.	Nilanaragam	Meliaceae	Moist deciduous forests, also in the plains	Peninsular India	Endemic Peninsular India
47	<i>Commelina ensifolia</i> R.Br.	Bearded Commelina	Commelinaceae	Grasslands and sacred groves	India, Sri Lanka and Australia	
48	<i>Ocimum tenuiflorum</i> L.	Krishna-thulasi, Thulasi	Lamiaceae	Grown as a sacred plant, elsewhere as an escape	Paleotropic	
49	<i>Sacciolepis indica</i>	Bocha-pul	Poaceae	Wetlands and marshy areas	Tropical Asia, Australia and introduced in Africa and America	
50	<i>Phyllanthus urinaria</i> L.	Chirukizhukanelli	Phyllanthaceae	In the plains, also in degraded deciduous forests	Native of Tropical East Asia; now a Circumtropical weed	Medicinal
51	<i>Wedelia chinensis</i> (Osbeck) Merr.	Aswagandhi / Kammal poovu	Compositae	Marshy areas	Indo-Malesia	
52	<i>Nymphaea nouchali</i> Burm.f.	Ambel/Vellampel	Nymphaeaceae	Ponds and pools in plains	Indo-Malesia and Tropical Africa	
53	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen		Compositae	Found in boggy ground, margins of ponds, marshes, along water	Indo-Malesia, America and New Guinea	

				courses and in rice fields.		
54	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Alligator weed	Amaranthaceae	Shallow water pools, ditches and marshes especially near railway tracks	Native of South America; now established in Indo-Malesia and Australia	Invasive Species
55	<i>Sesamum radiatum</i> Schum.		Pedaliaceae	Waste lands in rocky area	Native of Tropical West Africa: now widely spread	
56	<i>Corchorus capsularis</i> L.	Chanachedi	Malvaceae	Degraded forest areas and along sides of water courses	Cultivated in most Tropical countries	
57	<i>Cyperus platystylis</i> R.Br.		Cyperaceae	Marshy areas and margins of ponds	Indo-Malesia to Australia	
58	<i>Boerhavia diffusa</i> L.	Thazhuthama	Nyctaginaceae	Found by the waysides, wastelands, river banks and hedges	Pantropical	
59	<i>Brachiaria ramosa</i> (L.) Stapf	Chamapothaval	Gramineae	Grasslands and moist deciduous forests, roadsides and wastelands	Africa and Tropical Asia	
60	<i>Oldenlandia corymbosa</i> L.		Rubiaceae	Lateritic slopes	Southern Western Ghats (Kerala)	Endemic to Southern Western Ghats
61	<i>Spermacoce ocymoides</i> Burm.f.	Tharakeera	Rubiaceae	Wastelands	Indo-Malesia and Tropical Africa	
62	<i>Mitracarpus hirtus</i> (L.) DC.	Thaval	Rubiaceae	Degraded moist deciduous forests and wastelands	Tropical Africa and America; now common in South India	
63	<i>Schumannianthu</i>	<i>Malamkoov</i>	Marantaceae	Evergreen, semi	Indo-Pacific	

	<i>s virgatus</i>	<i>a</i>		evergreen and moist deciduous forests		
64	<i>Nymphoides cristata</i>		Menyanthaceae	Wetlands	Native of Asia, Introduced to North America	
65	<i>Curcuma aeruginosa</i>	Neelakua, Karimanjal	Zingiberaceae	Coastal areas and riverine alluvial soil	India and Myanmar	
66	<i>Impatiens maculata</i>		Balsaminaceae	Stream banks	Southern Western Ghats	Endemic to Southern Western Ghats
67	<i>Ophiorrhiza mungos</i>	<i>Avilpori, Chembajari nji</i>	Rubiaceae	Semi evergreen forests	Indo-Pacific	
68	<i>Brachiaria ramosa</i>		Poaceae	Grasslands and moist deciduous forests	African and Indo-Pacific	
69	<i>Cymbopogon flexuosus</i>	<i>Inchi pullu</i>	Poaceae	Deciduous forests	Indo-Pacific	
70	<i>Tridax procumbens</i> L.	Odiyancheera	Asteraceae	Deciduous forests, also waste lands in the plains	Native of Tropical America; now widespread throughout tropics and subtropics	Exotic
71	<i>Vigna unguiculata</i> (L.) Walp.	Achinga payar	Leguminosae	Cultivated	Cultivated in south Asia	
72	<i>Acampe praemorsa</i>	<i>Maravazha</i>	Orchidaceae	Moist deciduous forests	Indo-Pacific and African	
73	<i>Spermacoce latifolia</i> Aubl.	Vellatharavu/ Tharavu/Pachhapalla	Rubiaceae	Moist and dry deciduous forests and waste places	Native of Tropical America; now established in Tropical Africa and	Exotic

					Asia	
74	<i>Achyranthes bidentata</i> Blume	Cherukadal adi	Amaranthaceae	Evergreen forests	Indo-Malesia to Australia and East Asia	
75	<i>Alternanthera sessilis</i> (L.) R.Br.	Kozhuppa	Amaranthaceae	Along sides of water courses & marshy areas	Pantropical	
76	<i>Gomphrena globosa</i> L.	Vaadamalli	Amaranthaceae	Grown as ornamental	Native of Tropical America	Exotic
77	<i>Phyla nodiflora</i> (L.) Greene	Kattuthippali/ Neerthippali	Verbenaceae	Coastal sandy areas, paddy fields and stream sides	Tropics and subtropics	
78	<i>Cyperus javanicus</i> Houtt.		Cyperaceae	Marshy areas in degraded forests and mangrove forests, also in the plains	Pantropical	
79	<i>Evolvulus alsinoides</i> (L.) L.	Vishnu Kranthi	Convolvulaceae	Common along foothills, lower slopes, scrub jungles even in poor soils, on bare exposed slopes.	Tropical and subtropical regions of the world.	
80	<i>Fuirena ciliaris</i> (L.) Roxb.		Cyperaceae	Marshy areas in grasslands and paddy fields	Pantropical	
81	<i>Rhynchospora colorata</i> (L.) H. Pfeiff.		Cyperaceae	Wet grasslands, open marshes	Pantropical	
82	<i>Eleusine indica</i> (L.) Gaertn.	Raahi/ Kattuthina	Poaceae	Open plain areas, roadsides and wastelands	Pantropical	
83	<i>Cyperus haspan</i>		Cyperaceae	Stream banks	Indo-Pacific, South American and African	
84	<i>Pennisetum polystachyon</i> (L.) Schult.		Poaceae	Degraded moist deciduous forests and waste places	Paleotropics	
85	<i>Sporobolus diandrus</i> (Retz.)	Indian dropseed	Poaceae	Moist deciduous forests and waste	Indo-Malesia to Australia	

	P.Beauv.			lands		
86	<i>Physalis minima</i>	Njodinjotta, Njottanjodi an	Solanaceae	Degraded forests	Indo-Pacific, African and Australian	
87	<i>Curcuma neilgherrensis</i>	Koova	Zingiberacea e	Grasslands	Endemic to Western Ghats	
88	<i>Peperomia pellucida</i> (L.) Kunth.	Mashitandu Chedi	Piperaceae	Degraded forest areas and wastelands	Native of Tropical America; now Pantropical	Exotic
89	<i>Persicaria glabra</i> (Willd.) M.Gómez.	Chuvanna mudela mukkum	Polygonacea e	Common, grows gregariously in marshy areas	India, Nepal, Sri Lanka, South China, Africa, Afghanistan, South Japan, Malaysia.	
90	<i>Monochoria vaginalis</i>	Karimkoyal am	Pontederiace ae	Marshes	Indo-Pacific and Holarctic	
91	<i>Colocasia esculenta</i> (L.) Schott	Chembu	Araceae	Waterlogged ditches and streamside	Pantropical	Invasive Species
92	<i>Ananas comosus</i> (L.) Merr.	Kaithachakk a	Bromeliacea e	Cultivated	Tropical America, widely cultivated in the Paleotropics	
93	<i>Biophytum sensitivum</i> (L.) DC.	Theendavad i/Mukkutti	Oxalidaceae	Moist shady places	Indo-Malesia	
94	<i>Fimbristylis ferruginea</i> (L.) Vahl	West Indian Fimbry	Cyperaceae	Wet places and mangrove forests	Pantropical	
95	<i>Synedrella nodiflora</i> (L.) Gaertn.	Mudianpac ha	Compositae	Deciduous forests, also in the plains	Native of West Indies; naturalised in India, China, Malesia and Polynesia	Invasive Species
96	<i>Vernonia cinerea</i>	Puvankurun	Compositae	Deciduous forests,	Pantropics	Exotic

	(L.) Less.	al		also in the plains		
97	<i>Rivina humilis</i> L.	Rakthanelli/ Baby Pepper	Phytolaccaceae	Along roadsides and waste places	Native in Tropical America; naturalised in Indo-Malesia	
98	<i>Cyanotis axillaris</i>		Commelinaceae	Degraded deciduous forests	Indo-Pacific	
99	<i>Typha angustifolia</i> L.	Payapullu	Typhaceae	Marshy fields	Cosmopolitan	
100	<i>Centella asiatica</i> (L.) Urb.	Kodangal	Apiaceae	Deciduous forests, also in wet places in the plains	Tropical Asia and Africa	Medicinal
101	<i>Capsicum frutescens</i> cv. Nagahari	Kantharimulaku	Solanaceae	Cultivated	Tropical America: widely cultivated	Exotic
102	<i>Pistia stratiotes</i> L.	Tropical duck-weed	Araceae	It is a free-floating plant.	Widespread and common species from Africa to southeast Asia	Invasive Species
103	<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.	Kolinchi	Zingiberaceae	Evergreen forests	India, Sri Lanka and Malesia	
104	<i>Cyperus stoloniferus</i>		Cyperaceae	Stream banks	African, Indo-Pacific and Australian	
105	<i>Justicia japonica</i> Thunb.		Acanthaceae	Grasslands and waste places	Indo-Malesia and East Africa	
106	<i>Hygrophila schulli</i> (Buch.-Ham.)	Vayalchulli	Acanthaceae	Paddy fields and other moist localities	India, Myanmar and Indo-China	
107	<i>Mollugo pentaphylla</i> L.	Parpadakapullu	Aizoaceae	Open areas and along banks of streams, also in deciduous forests	Pantropical	
108	<i>Phalaenopsis deliciosa</i>		Orchidaceae	Semi evergreen and evergreen forests	Indo-Pacific	
109	<i>Rhynchostylis</i>	Seethamudi	Orchidaceae	Moist deciduous	Indo-Pacific	

	<i>retusa</i>			forests and sacred groves		
110	<i>Cynodon dactylon</i> (L.) Pers.	Karukapullu	Poaceae	Along banks of backwaters, bunds of paddy fields and wastelands	Tropical and warm temperate regions of the world	
111	<i>Ilysanthes rotundifolia</i> (L.) Benth.		Linderniaceae	It is found in rice fields, particularly after harvesting, along ditches and the edges of ponds and tanks	Paleotropics	
112	<i>Asystasia dalzelliana</i> Sant.	Violet Asystasia	Acanthaceae	Evergreen and semi-evergreen forests and also in the plains	Tropical Asia and Africa	
113	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Kakkakalan pullu	Poaceae	Marshy lands and open areas	Native of South America, naturalised in Paleotropics	
114	<i>Stenotaphrum secundatum</i>	St. Augustine grass	Poaceae	Grown as fodder/lawn grass	Native of Central and north America	Exotic
115	<i>Acmella calva</i>	Tharippuchedi, Naimanjil	Asteraceae	Moist localities in evergreen forests	Indo-Malesia and China	
116	<i>Panicum notatum</i>		Poaceae	Stream banks	Indo-Pacific	
117	<i>Panicum auritum</i> J.Presl ex Nees		Poaceae	Wet lands and margins of forests	Indo-Malesia and China	
118	<i>Paspalum conjugatum</i> P.J.Bergius	Hilograss	Poaceae	Banks of backwaters and rivers	Pantropical	
119	<i>Sida acuta</i> Burm.f.	Kurunthotti	Malvaceae	Dry and moist deciduous forests, also in the plains	Pantropical	
120	<i>Spermacoce hispida</i> L.	Tharthavel	Rubiaceae	Sandy low lands	Peninsular India	Exotic
121	<i>Panicum paludosum</i>		Poaceae	Paddy fields, marshes and still	Paleotropics	

	Roxb.			waters		
122	<i>Pennisetum orientale</i> Rich.		Poaceae	Cultivated as fodder grass, often found running wild	Central Asia and North Africa	
123	<i>Salvinia molesta</i> D.S. Mitch.		Salviniaceae	Weed of still and slow flowing fresh water, Aquatic fern	Native to Brazil and now spread world wide	Invasive species
124	<i>Phyllanthus reticulatus</i> Poir.	Nirneli/Nee roli	Phyllanthaceae	Stream banks, lake shores and also in moist deciduous and semi-evergreen forests	Paleotropics	
125	<i>Sphaeranthus africanus</i> L.	Velutha-adakkamaniyan	Asteraceae	Paddy fields and marshy areas	Indo-Malesia, China and Australia	
126	<i>Trianthema portulacastrum</i> L.	Manal vallikeera	Aizoaceae	Paddy fields and other moist localities	Tropics of the World	
127	<i>Oryza sativa</i> L.	Nellu	Poaceae	Cultivated	Widely cultivated	
128	<i>Ruellia tuberosa</i> L.		Acanthaceae	Wasteland	Native of Tropical America; Naturalised in India and Malesia	Exotic
129	<i>Physalis minima</i>	Njodinjotta, Njottanjodan	Solanaceae	Degraded forests	Indo-Pacific, African and Australian	
130	<i>Euphorbia hirta</i> L.	Nilappaala	Euphorbiaceae	Degraded forest areas and forest plantations, also in the plains	Pantropical.	
131	<i>Eclipta prostrata</i> (L.) L.	Kayyunni	Compositae	Paddy fields and moist localities	Pantropical	Invasive Species
132	<i>Nymphaea stellata</i>	Ambal	Nymphaeaceae	Wetland	Native to southern and eastern parts of Asia	
133	<i>Eragrostis japonica</i>		Poaceae	Stream banks	Indo-Pacific, South American	

					and African	
134	<i>Anisomeles indica</i>	Chedayan,	Lamiaceae	Dry deciduous forests	Indo-Pacific and Holarctic	
135	<i>Azolla pinnata</i>	Azolla	Salviniaceae	In wetlands, wet areas	India, Japan, Asia, Australia and Africa	
136	<i>Pouzolzia indica</i> (L.) Gaudich.	Kallurukki	Urticaceae	Wastelands	Tropical Asia	
137	<i>Blumea lacera</i> (Burm.f.) DC.	Kukkura-chedi	Compositae	Dry deciduous forests, also in the plains	Paleotropics	
138	<i>Ludwigia perennis</i> L.	Neerkarayambu	Onagraceae	Waterlogged areas in grasslands	Tropical Africa, Asia and Australia	
139	<i>Sesamum indicum</i>	Ellu	Pedaliaceae	Plains, Cultivated		
140	<i>Phyllanthus amarus</i> Schum. & Thonn.	Keezharnelli /Phyllanthus	Phyllanthaceae	Degraded moist deciduous, forest plantations and also in plains	Tropics	Medicinal
141	<i>Elephantopus scaber</i> L.	Aanachuvadi	Compositae	Moist deciduous forests, also in the plains	Pantropical	
142	<i>Scoparia dulcis</i> L.	Kallurukki	Plantaginaceae	Wasteplaces	Native of Tropical America; now Pantropical	Exotic
143	<i>Senna tora</i> (L.) Roxb.	Thakara	Leguminosae	Moist deciduous forests, also in the plains	Native of South America	Invasive Species
144	<i>Adenosma indiana</i>	Kasithumba	Plantaginaceae	Grasslands, deciduous and semi-evergreen forests	Indo-Malesia	
145	<i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees	Nilavepu	Acanthaceae	Scrub jungles, also in the plains	Peninsular India and Sri Lanka	
146	<i>Senna alata</i> (L.) Roxb.	Malamthakara/Candle Bush	Leguminosae	Along riversides and margins of ponds	Pantropical	

147	<i>Bryophyllum pinnatum</i>	<i>Ilamulachi, Elachedi,</i>	Crassulaceae	Moist deciduous forests	African, Indo-Pacific and South American	
148	<i>Limnocharis flava (L.) Buchenau</i>	Yellow velvetleaf	Alismataceae	Growing in wet, waterlogged, exposed lands and rice fields	Native to Southeast Asia	
149	<i>Lycopodiella cernua</i>		Lycopodiaceae	Forest roadside cuttings, walls	Indo-Pacific, Australian, South American and African	
150	<i>Monochoria vaginalis (Burm.f.) C.Presl</i>	Karimkovalum	Pontederiaceae	Paddy fields and wet lowlands	India to China, Malesia and Japan	Aquatic
151	<i>Torenia bicolor Dalz.</i>	Kakkapoovu	Scrophulariaceae	Marshy areas	Western Ghats	Endemic to Western Ghats
152	<i>Ruellia prostrata Poir</i>	Irula	Acanthaceae	Found in the disturbed areas, foot paths and agricultural lands	India	
153	<i>Cyperus corymbosus Rottb.</i>		Cyperaceae	Along banks of streams	Pantropical	
154	<i>Cyperus iria L.</i>	Iria flatsedge	Cyperaceae	Degraded deciduous forests, marshy areas and paddy fields	Tropical Asia and East Africa; introduced in U.S.A and West Indies	
155	<i>Sacciolepis interrupta (Willd.) Stapf.</i>		Poaceae	Wetlands	Tropics of South East Asia and Africa	
156	<i>Sida cordifolia L.</i>	Anakurunthotti/Vellooram	Malvaceae	Common along roadsides, sandy sea coasts and wastelands	Pantropical	
157	<i>Rhynchospora</i>		Cyperaceae	Wet grasslands,	Pantropical	

	<i>corymbosa</i> (L.) Britton.			open marshes		
158	<i>Triumfetta rhomboidea</i> Jacq.	Ottukayal/Oorpam	Malvaceae	Degraded deciduous forests, also in the plains	Pantropical	
159	<i>Amaranthus viridis</i>	Kuppacheera, Kuppakeera	Amaranthaceae	Wastelands, open fields	Pantropical	
160	<i>Ludwigia adscendens</i> (L.) H. Hara.	Water Primrose	Onagraceae	Ponds and ditches	Continental Asia, Malesia and Australia	
161	<i>Ludwigia palustris</i> (L.) Elliott		Onagraceae	Aquatic Plant	Native of North America	Exotic
162	<i>Bacopa monnieri</i> (L.) Wettst	Bhrammi	Plantaginaceae	Common in low-lying marshy places, along watercourses.	Paleotropics	Invasive species
163	<i>Pogostemon cablin</i> (Blanco) Benth.		Lamiaceae	Cultivated	Native of Indo Malaysian Region	
164	<i>Pogostemon paniculatus</i> (Willd.) Benth		Lamiaceae	Moist deciduous and semi-evergreen forests and wastelands	Peninsular India and Myanmar	
165	<i>Leersia hexandra</i> Sw.		Poaceae	Wetlands	Pantropical	
165	<i>Oplismenus compositus</i> (L.) P.Beauv.		Poaceae	Degraded deciduous forests and shady places, also in the plains	Pantropical	
166	<i>Cyperus rotundus</i>		Cyperaceae	In the plains, fallow lands and agricultural fields	Pantropical	
167	<i>Eleocharis retroflexa</i>		Cyperaceae	Marshy areas in grassland and riversides	Paleotropics	
168	<i>Fimbristylis dichotoma</i>		Cyperaceae	Degraded deciduous forest, cultivated lands and riverbanks	Pantropical	
169	<i>Alloteropsis</i>		Poaceae	Moist and dry		

	<i>cimicina</i>			deciduous forest, roadsides and wastelands		
170	<i>Kyllinga brevifolia</i> Rottb.	Nutsedge	Cyperaceae	Marshy areas, wastelands and roadsides	Pantropical	
171	<i>Elatostema acuminatum</i>		Urticaceae	Riverbanks	Indo-Pacific	
172	<i>Begonia crenata</i>			Stream banks	Western Ghats	Endemic to Western Ghats
173	<i>Lindernia anagallis</i> (Burm. f.) Pennell		Linderniaceae	Banks of streams and marshy areas	Indo-Malesia	
174	<i>Lindernia crustacea</i> (L.) F.v.Muell.	Brittle False Pimpernel/ Malaysian False Pimpernel	Scrophulariaceae	Moist deciduous forests and wastelands	Africa, America and Tropical and Subtropical Asia	
175	<i>Cleome rutidosperma</i> DC.	Neelavela	Cleomaceae	In coastal areas	Pantropical	
176	<i>Curculigo orchioides</i>	Nilappana	Hypoxidaceae	Moist deciduous forests	Indo-Pacific	
177	<i>Crinum viviparum</i>	Veluthapola thali	Amaryllidaceae	Stream and riverbanks	Indo-Pacific	
178	<i>Hanguana malayana</i>		Hanguanaceae	Riparian forests	Indo-Pacific and Australian	
179	<i>Musa paradisiaca</i> L.	Vazha	Musaceae	Cultivated	Cultivated throughout the tropics	
180	<i>Kyllinga squamulata</i> Vahl.		Cyperaceae	Degraded semi-evergreen and deciduous forests	Tropical Asia and Africa	
181	<i>Scleria laevis</i> Retz.		Cyperaceae	Degraded forests, fallow fields and roadsides	Indo-Malesia, China and Australia	
182	<i>Zingiber wightianum</i> Thwaites	Malayinji	Zingiberaceae	Evergreen forests	Peninsular India and Sri Lanka	
183	<i>Eleutheranthera</i>		Compositae	Degraded moist	Native of	

	<i>ruderalis</i> (Sw.) Sch.Bip.			deciduous forests, also in the plains	Tropical America; now established in several Asian countries	
184	<i>Lindernia antipoda</i> (L.)		Linderniaceae	Sides of streams, reservoirs and marshy areas	Tropical and Subtropical Asia and Australia	
185	<i>Mimosa pudica</i> L.	Thottavadi	Leguminosae	Common on moist and ungrazed places. Near riverbanks, bunds of arable lands, fallow lands and water courses.	Native of South America, now pantropical.	Exotic
186	<i>Globba sessiliflora</i> Sims.	Kolchanna/ Kattinji	Zingiberaceae	Along stream sides in evergreen forests	India to Thailand	
187	<i>Achyranthes aspera</i> L.	Katalaati	Amaranthaceae	Abundant in plantation of the hills	Tropics.	
188	<i>Cabomba caroliniana</i> A.Gray		Cabombaceae	Aquatic Herb	Native of N. America	Exotic

LIST OF CLIMBERS

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Status
1	<i>Derris trifoliata</i> Lour.	Ponumvalli	Leguminosae	Along banks of backwaters and mangrove forests	Paleotropics	
2	<i>Clitoria ternatea</i> L.	Sangu Pushpam /Butterfly Bean	Leguminosae	Common on waysides, thickets, scrub jungles. Widely cultivated in the tropics.	Native of South America	Exotic
3	<i>Canavalia gladiata</i> (Jacq.) DC.	Valaringha/Vet tukatthipayar	Leguminosae	Grown as vegetable	Pantropical	

4	<i>Mimosa diplotricha</i> var. <i>diplotricha</i>	Aanathottavadi	Leguminosae	Weed in degraded forests, also in the plains	Native of Tropical America; a weed in India	Exotic/Invasive species
5	<i>Pueraria phaseoloides</i> (Roxb.) Benth.	Thotta-payar	Leguminosae	Along margins of cultivated lands	Tropical Asia	Invasive Species
6	<i>Dioscorea bulbifera</i> L.	Kaacchil	Dioscoreaceae	Moist deciduous forests, also in the plains	Paleotropics	
7	<i>Cayratia pedata</i> (Lam.) Gagnep.	Corivalli/Tripadi	Vitaceae	Moist deciduous and semi-evergreen forests, also in sacred groves in the plains	Indo-Malesia	
8	<i>Ipomoea cairica</i> (L.) Sweet.	Kolambipoo	Convolvulaceae	Moist & Dry deciduous forests, also in the plains	Paleotropics	
9	<i>Anamirta cocculus</i> (L.) Wight & Arn.	Nanchuvalli	Menispermaceae	Moist deciduous and evergreen forests, also sacred groves in the plains	Indo-Malesia	
10	<i>Cyclea peltata</i> (Lam.) Hook. f. & Thoms.	Padathali	Menispermaceae	Semi-evergreen and evergreen forests, also in the plains	India and Sri Lanka	
11	<i>Luffa acutangula</i>	Peechanga	Cucurbitaceae	Cultivated	Indo-Pacific	
12	<i>Momordica charantia</i>	Paval, Pavaykka	Cucurbitaceae	Cultivated	Indo-Pacific	
13	<i>Calamus travancoricus</i>	Vallichooral		Evergreen forests	Southern Western Ghats	Endemic to Southern Western Ghats
14	<i>Ziziphus oenopolia</i> (L.) Mill.	Thodalli	Rhamnaceae	More common on the lower slopes. Plains from the coast to 1200m.	Tropical Asia and Australia. Throughout the hotter parts of India	
15	<i>Smilax zeylanica</i> L.	Valiyakanni/Arikanni	Smilacaceae	Moist deciduous and semi-evergreen forests, also in the	Indo-Malesia	

				plains		
16	<i>Coccinia grandis</i> (L.) Voigt	Koval	Cucurbitaceae	Dry deciduous forests and wastelands, also cultivated	Peninsular India and Sri Lanka	
17	<i>Jasminum sambac</i> (L.) Aiton	Mulla	Oleaceae		Cultivated	
18	<i>Tylophora indica</i> (Burm.f.) Merr.	Vallippala	Asclepiadaceae	Common along the wayside thickets, scrub jungles and wastelands	India to South east Asia, Sri Lanka, Malaysia	
19	<i>Grewia umbellifera</i>	Bhasmavalli	Malvaceae	Evergreen forests	Western Ghats	Endemic to Western Ghats
20	<i>Sarcostigma kleinii</i>	Erumatthali, Odal	Ilacaceae	Evergreen and semi evergreen forests	Indo-Pacific	
21	<i>Strychnos potatorum</i>	Chillam	Loganiaceae	Dry deciduous forests	Indo-Pacific	
22	<i>Vanilla planifolia</i>		Orchidaceae	Cultivated	South American	
23	<i>Centrosema pubescens</i> Benth.	Kattupayar	Leguminosae	Forest plantations and Deciduous forests, also in the plains	Native of America; introduced in India	Climber
24	<i>Ipomoea obscura</i> (L.) Ker-Gawl.	Thiruthali/Cherutali/Tirutali	Convolvulaceae	Plains, upto 1400m in arable lands. Tropics.	China, Tropical Asia and Africa	Exotic
25	<i>Toxocarpus kleinii</i> Wight & Arn.		Asclepiadaceae	Moist deciduous forests and sacred groves	Peninsular India and Sri Lanka	
26	<i>Entada rheedei</i>	Kakkavalli, Kukkumkai	Fabaceae	Riverbanks	Indo-Pacific	
27	<i>Ipomoea fistulosa</i>		Convolvulaceae	Cultivated	South American, African and Indo-Pacific	
28	<i>Ipomoea mauritiana</i>		Convolvulaceae	Moist deciduous forests	Indo-Pacific, South American and	

					African	
29	<i>Merremia hederacea</i>		Convolvulaceae	Degraded forests	Indo-Pacific and African	
30	<i>Abrus precatorius</i> L.	Kunnikuru	Leguminosae	Deciduous forests, also in the plains	Pantropical	
31	<i>Aniseia martinicensis</i>	Venthiruthali	Convolvulaceae	Marshes and backwaters	Indo-Pacific, South American and African	
32	<i>Cayratia trifolia</i> (L.) Domin.	Vathakkodi/ Kattuperanta	Vitaceae	Semi-evergreen forests and mangrove forests, also in the plains	Indo-Malesia, China and Australia	
33	<i>Jasminum multiflorum</i> (Burm.f.) Andr.	Kudamulla	Oleaceae	Moist Deciduous to Evergreen Forests, also Planted	Indo-Malesia & China	
34	<i>Jasminum multiflorum</i>	Kasthurimulla	Oleaceae	Semi evergreen and moist deciduous forests	Indo-Pacific and Holarctic	
35	<i>Epipremnum aureum</i>	Money plant	Araceae		Native in Mo'orea, French Polynesia	
36	<i>Cucurbita maxima</i> Duchesne.	Mathan	Cucurbitaceae	Cultivated as vegetable	Cosmopolitan, mostly cultivated	
37	<i>Uvaria narum</i> Wall.	Narumpanal	Annonaceae	Along coastal areas and deciduous forests at low altitudes	South India and Sri Lanka	
38	<i>Artabotrys zeylanicus</i>	Manoranjini	Annonaceae	Semi evergreen and evergreen forests	Indo-Pacific	
39	<i>Chonemorpha fragrans</i>	Appuppanthadi, Mutthappanthadi,	Apocynaceae	Evergreen forests and sacred groves in the plains	India, Myanmar, Sri Lanka and Andaman and Nicobar Islands	
40	<i>Clematis gouriana</i>	Nikidakodi	Ranunculaceae	Moist deciduous forests	Indo-Pacific	
41	<i>Cissus javana</i>	Njerinjampuli	Vitaceae	Moist deciduous forests and semi evergreen	Indo-Pacific	

				forests		
42	<i>Wattakaka volubilis</i> (L.f.) Stapf.	Vattakakkakko ti	Aslepiadaceae	Moist deciduous forests and scrub jungles	Indo-Malesia and China	
43	<i>Jasminum rottlerianum</i>	Kattumulla	Oleaceae	Evergreen, shola and moist deciduous forests	Indo-Pacific	
44	<i>Dioscorea alata</i>	Kaavuth, Kaachil	Dioscoreaceae	Cultivated, also naturalised	India	
45	<i>Calycopteris floribunda</i> (Roxb.) Lam. ex Poir.	Pullani	Combretaceae	Moist deciduous forest, also in the plains	Indo-Malesia	
46	<i>Getonia floribunda</i> Roxb.	Pullanni	Combretaceae	Moist deciduous forest, also in the plains	Indo-Malesia	
47	<i>Piper nigrum</i> L. var. <i>nigrum</i>	Kurumulaku	Piperaceae	Evergreen and semi-evergreen forests, also cultivated	Peninsular India and Sri Lanka, cultivated elsewhere	
48	<i>Dendrophthoe falcata</i> (L.f.) Ettingsh.	Ittikanni	Loranthaceae	Found in foothill scrub jungles and deciduous forests from plains to 1000m.	India, Sri Lanka, Thailand, Indo-China and Australia.	
49	<i>Hemidesmus indicus</i> R.Br.	Nannaari/Naruneendi	Asclepiadaceae	Sighted growing solitary in tilled or burnt fields. Plains from the coast, in scrub jungles and upto 1000m on the slopes.	India and Sri Lanka.	
50	<i>Hewittia malabarica</i> (L.) Suresh	Ohanamvalli	Convolvulaceae	Moist and dry deciduous forests, also in the plains	Asia, Africa and South America	
51	<i>Bougainvillea glabra</i> Choisy.	Bougainvillea	Nyctaginaceae	Cultivated	Native of Tropical America	Exotic
52	<i>Tinospora sinensis</i> (Lour.) Merr.	Kattamruthu	Menispermaceae	Evergreen and moist deciduous forests, also in sacred groves	India to Indo-China	

				in the plains		
53	<i>Bauhinia phoenicea</i>	Vallimandaram	Fabaceae	Evergreen and semi evergreen forests	Western Ghats	Endemic to Western Ghats
54	<i>Tragia involucreta</i> L.	Valli choriyanam/Ko dithoova	Euphorbiaceae	Wastelands	India and Sri Lanka	
55	<i>Pothos scandens</i> L.	Paruvakodi	Araceae	Evergreen forests, waste places and sacred groves	India to Malesia and Madagascar	
56	<i>Cissampelos pareira</i>	Malathangi	Menispermaceae	Deciduous forests	Indo-Pacific	
57	<i>Tiliacora acuminata</i>	Vallikanjiram	Menispermaceae	Moist deciduous forests	Indo-Pacific	
58	<i>Aristolochia indica</i> L.	Garudakodi	Aristolochiaceae	Degraded moist deciduous forests, also in the plains growing along fences	Indo-Malesia	
59	<i>Thunbergia alata</i> Boj. ex Sims	Potato Creeper	Acanthaceae	Cultivated	Native of Tropical Africa	Exotic
60	<i>Marsdenia sylvestris</i> (Retz.) P.I.Forst.	Chakkarakolli	Apocynaceae	Moist and dry deciduous forests, also in the plains	Indo-Malesia	
61	<i>Mikania micrantha</i> Kunth	Vayara	Compositae	Forest plantations and also in the plains in moist localities	Pantropical	Invasive species, climber
62	<i>Ichnocarpus frutescens</i> (L.) R.Br.	Palvalli	Apocynaceae	Moist and dry deciduous forests, also in the plains	Indo-Malesia and Australia	
63	<i>Hugonia mystax</i> L.	Modirakkanni/Karthotti	Linaceae	Moist deciduous forests, also in the plains	India and Sri Lanka	
64	<i>Acacia pennata</i>	Karincha	Fabaceae	Moist deciduous forests	Indo-Pacific and African	
65	<i>Cryptolepis dubia</i>		Apocynaceae	Moist and dry deciduous forests	Indo-Pacific	
66	<i>Tinospora cordifolia</i>	Amrthu	Menispermaceae	Moist deciduous forests and scrub	Sri Lanka, India,	

	(Willd.) Hook.f. & Thoms.			jungles, also in the plains	Bangladesh and Myanmar	
67	<i>Passiflora foetida</i> L.	Poodapazham	Passifloraceae	Very common along roadsides, thickets and water courses from plains	Native of tropical America, now widely naturalized the tropics	Exotic
68	<i>Salacia fruticosa</i> Wall.	Ponkarandi/Eakanayakam	Hippocrateaceae	Evergreen and semi-evergreen forests, also in the sacred groves and plains	Western Ghats	Endemic to Southern Western Ghats
69	<i>Ipomoea aquatica</i> Forssk.	Kozhuppa	Convolvulaceae	Ponds and lakes	Pantropics	
70	<i>Piper galeatum</i>		Piperaceae	Semi evergreen and evergreen forests	Southern Western Ghats	Endemic to Southern Western Ghats
71	<i>Cayratia japonica</i> (Thunb.) Gagnep.		Vitaceae	Moist deciduous forests	Indo-Malesia	
72	<i>Cardiospermum halicacabum</i> L.	Uzhinja	Sapindaceae	Moist deciduous forests, also in scrub jungles	Pantropical	
73	<i>Passiflora edulis</i>		Passifloraceae	Cultivated	South American	
74	<i>Combretum indicum</i>	Thookuchedi	Combretaceae	Cultivated	Indo-Pacific	
75	<i>Rhaphidophora pertusa</i>	Anamakudam	Araceae	Evergreen forests	Indo-Pacific	
76	<i>Asparagus racemosus</i> Willd.	Sathavari	Liliaceae	All forest types, also in the plains	Paleotropics	
77	<i>Gloriosa superba</i> L.	Menthonni	Liliaceae	Semi-evergreen, moist deciduous and dry deciduous forests, also in the	Paleotropics	

				plains		
78	<i>Merremia tridentata</i> (L.)	Prasarani	Convolvulaceae	Plains, Dry Localities	Deciduous forests, also in the plains	Paleotropics
79	<i>Merremia vitifolia</i> (Burm. f.) Hallier f.	Manja kolambivalli	Convolvulaceae	Degraded forest areas and also in the plains	Indo-China and China	Exotic
80	<i>Acacia caesia</i>	Velutha-incha	Fabaceae	Evergreen and semi-evergreen forests	Indo-Malesia	
81	<i>Alangium salviifolium</i>	Arinjil, Irinjil	Cornaceae	Forested areas		
82	<i>Ancistrocladus heyneanus</i>	Modiravalli	Ancistrocladaceae	Evergreen Forests	South India and Sri Lanka	
83	<i>Benincasa hispida</i>	Kumbalam	Cucurbitaceae	Cultivated	Native of Indonesia	
84	<i>Calamus gamblei</i>	Chooral, Pachural	Arecaceae	Evergreen forests	Western Ghats	
85	<i>Cassytha filiformis</i>	Moodillathali	Lauraceae	Among bushes in plains	Pantropical	
86	<i>Coccinia grandis</i>	Koval	Cucurbitaceae	Dry deciduous forests, also Cultivated	Peninsular India and Sri Lanka	

LIST OF FERNS

SN	Botanical Name	Common Name	Family	Habitat	Distribution	Remarks
1	<i>Adiantum caudatum</i>		Pteridaceae	Semi evergreen and moist deciduous forests	Indo-Pacific and African	
2	<i>Salvinia adnata</i>	African Payal	Salviniaceae	Riparian marshes, aquatic, free floating,	South American	
3	<i>Selaginella tenera</i> Spring.	Sanjeevani	Selaginellaceae	Found commonly on the forest floor and at road side rocks.		
4	<i>Marsilea minuta</i>		Marsileaceae	Riparian marshes	Indo-Pacific and African	
5	<i>Adiantum philippense</i>		Pteridaceae	Growing in moist areas of all	Tropics and subtropics	

				vegetation types from coastal plains to forests.		
6	<i>Selaginella delicatula</i>		Selaginellaceae	Evergreen forests	Indo-Pacific	
7	<i>Adiantum latifolium</i> Lam.		Adiantaceae	Disturbed open areas.	Native to tropical America	Exotic
8	<i>Pteris longipes</i> D. Don		Pteridaceae			
9	<i>Pityrogramma calomelanos</i> (L.) Link	Silver fern	Adiantaceae	Common on open ground in fairly exposed places	American origin, now widely distributed in pan-tropics	
10	<i>Dicranopteris linearis</i>		Gleicheniaceae	Degraded forests	Indo-Pacific, South American and African	
11	<i>Lygodium flexuosum</i> (L.) Sw.	Climbing Fern	Schizaeaceae	Open ground, forming a tangled mass or the very long and wiry fronds twining round surrounding shrubs and trees.	From Sri Lanka and the Himalayas to southern China, Hong Kong, Ryukyu Islands, throughout Southeast Asia to northern Queensland.	
12	<i>Drynaria quercifolia</i> (L.) J. Sm.	Basket fern, Oak-leaf fern	Polypodiaceae	Basket ferns are grown on trees or grown on rocks.	Native to tropical Africa, South Asia, East Asia, Southeast Asia, Australia, and Oceania	Exotic
13	<i>Selaginella inaequalifolia</i>		Selaginellaceae	Evergreen forests	Indo-Pacific	
14	<i>Acrostichum heterophyllum</i>		Pteridaceae	Stream banks	Indo-Pacific and African	
15	<i>Antrophyum plantagineum</i>		Pteridaceae	Stream banks	Indo-Pacific and Australian	
16	<i>Pteris quadriaurita</i> Retz.		Pteridaceae		Native to subtropical India.	

FAUNAL DIVERSITY

Mammals	:	23 species
Birds	:	96 species
Reptiles	:	24 species
Amphibians	:	13 species
Butterflies	:	78 species
Odonates	:	28 species
Spiders	:	25 species

List of Mammals (In and around the project site)

SN	Common Name	Scientific Name	IUCN Status	IW(P)A (Schedule)
1	Pig Rat	<i>Bandicota indica</i>	Least Concern	V
2	Common House Rat	<i>Rattus rattus</i>	Least Concern	V
3	Common mongoose	<i>Herpestes edwardsi</i>	Least Concern	II
4	Leopard cat	<i>Felis bengalensis</i>	Least Concern	I
5	Indian false vampire	Naracheer	Least Concern	IV
6	Black-Naped Hare	<i>Lepus nigricollis</i>	Least Concern	IV
7	Wild dog (Dhole)	<i>Cuon alpinus</i>	Endangered	II
8	Bonnet Macaque	<i>Macaca radiata</i>	Least Concern	V
9	Indian giant squirrel	<i>Ratufa indica</i>	Vulnerable	II
10	Palm Civet/Toddy Cat	<i>Paradoxurus hermaphroditus</i>	Least Concern	II
11	Common Yellow Bat	<i>Scotophilus heathi</i>	Least Concern	V
12	Jackal	<i>Canis aureus</i>	Least Concern	II
13	Common Otter	<i>Lutra lutra</i>	Least Concern	II
14	Lesser Bandicoot Rat	<i>Bandicota bengalensis</i>	Least Concern	V
15	Indian Porcupine	<i>Hystrix indica</i>	Least Concern	II
16	Common Indian Field Mouse	<i>Mus booduga</i>	Least Concern	V
17	Three Striped Palm Squirrel	<i>Funambulus palmarum</i>	Least Concern	V
18	House Mouse	<i>Mus musculus</i>	Least Concern	V

19	Greater Short-nosed Fruit Bat	<i>Cynopterus sphinx</i>	Least Concern	V
20	Jungle Cat	<i>Felis chaus</i>		II
21	Indian Flying Fox	<i>Pteropus giganteus</i>	Least Concern	V
22	Indian Wild Boar	<i>Sus scrofa</i>	Least Concern	V
23	House Shrew	<i>Suncus murinus</i>	Least Concern	V

* IW(P)A -The Indian Wildlife (Protection) Act, 1972.

List of Reptiles

SN	Scientific Name	Common Name	IUCN Status
1	<i>Melanochelys trijuga</i>	Indian Black Turtle	Near threatened
2	<i>Ahaetulla pulverulenta</i>	Brown Vine Snake	Least Concern
3	<i>Oligodon arnensis</i>	Common Kukri Snake	Not evaluated
4	<i>Eutropis macularia</i>	Bronze Grass Skink	Least Concern
5	<i>Vipera russelli</i>	Russell's viper	Not evaluated
6	<i>Calotes versicolor</i>	Oriental Garden Lizard	Least Concern
7	<i>Bungarus caeruleus</i>	Common krait	Not evaluated
8	<i>Xenochrophis piscator</i>	Checkered Keel-back	Not evaluated
9	<i>Python molurus</i>	Indian python	Least Concern
10	<i>Gryptotyphlops acutus</i>	Brahminy blind snake	Not evaluated
11	<i>Ahaetulla nasuta</i>	Common Vine Snake	Not evaluated
12	<i>Eryx conicus</i>	Common Sand Boa	Not evaluated
13	<i>Eutropis carinata</i>	Common Keeled Skink	Least Concern
14	<i>Ptyas mucosa</i>	Oriental Rat Snake	Least Concern
15	<i>Coelognathus helena</i>	Common Trinket Snake	Not evaluated
16	<i>Hemidactylus brookii</i>	Brook's House Gecko	Not evaluated
17	<i>Dendrelaphis tristis</i>	Common Indian Bronze-back	Least Concern
18	<i>Varanus bengalensis</i>	Common Indian monitor	Least Concern
19	<i>Lycodon aulicus</i>	Common Wolf Snake	Not evaluated
20	<i>Draco dussumieri</i>	South Indian Flying Lizard	Least Concern

21	<i>Naja naja</i>	Asian cobra	Least Concern
22	<i>Hemidactylus maculatus</i>	Spotted House Gecko	Least Concern
23	<i>Hemidactylus leschenaultii</i>	Bark Gecko	Least Concern
24	<i>Hemidactylus frenatus</i>	Asian House Gecko	Least Concern

List of Birds

SN	Scientific Name	Common Name	Family	IUCN Status	Remarks
1	<i>Bubulcus ibis</i>	Cattle Egret	Ardeidae	Least Concern	
2	<i>Phalacrocorax niger</i>	Little Cormorant	Phalacrocoracidae	Least Concern	
3	<i>Centropus sinensis</i>	Greater coucal	Cuculidae	Least Concern	
4	<i>Halcyon capensis</i>	Stork-billed Kingfisher	Alcedinidae	Least Concern	
5	<i>Clamator jacobinus</i>	Pied Crested Cuckoo	Cuculidae	Least Concern	
6	<i>Ardeola grayii</i>	Indian Pond Heron	Ardeidae	Least Concern	
7	<i>Merops orientalis</i>	Small Green Bee Eater	Meropidae	Least Concern	
8	<i>Dicaeum agile</i>	Pale billed Flowerpecker	Dicaeidae	Least Concern	
9	<i>Aviceda jerdoni</i>	Jerdon's Baza	Accipitridae	Least Concern	
10	<i>Psittacula krameri</i>	Rose ringed parakeet	Psittacidae	Least Concern	
11	<i>Haliastur indus</i>	Brahminy kite	Accipitridae	Least Concern	
12	<i>Spilornis cheela</i>	Crested Serpent-Eagle	Accipitridae	Least Concern	
13	<i>Zoothera citrina</i>	White throated ground thrush	Muscicapidae	Least Concern	
14	<i>Prinia inornata</i>	Plain Prinia	Cisticolidae	Least Concern	
15	<i>Acridotheres tristis</i>	Common Myna	Sturnidae	Least Concern	
16	<i>Seicercus trochiloides</i>	Greenish Leaf Warbler	Phylloscopidae	Least Concern	

17	<i>Chalcophaps indica</i>	Emerald Dove	Columbidae	Least Concern	
18	<i>Glaucidium radiatum</i>	Jungle Owlet	Strigidae	Least Concern	
19	<i>Mesophoyx intermedia</i>	Median Egret	Ardeidae	Least Concern	
20	<i>Nectarinia lotenia</i>	Loten's Sunbird	Nectariniidae	Least Concern	
21	<i>Acrocephalus dumetorum</i>	Blyth's Reed Warbler	Muscicapidae	Least Concern	Winter Visitor
22	<i>Merops philippinus</i>	Blue tailed Bee Eater	Meropidae	Least Concern	Winter Visitor
23	<i>Saxicoloides fulicata</i>	Indian Robin	Muscicapidae	Least Concern	
24	<i>Dinopium benghalense</i>	Black-rumped Flameback	Picidae	Least Concern	
25	<i>Gallus sonneratii</i>	Grey Junglefowl	Phasianidae	Least Concern	Endemic
26	<i>Oriolus xanthornus</i>	Black hooded oriole	Oriolidae	Least Concern	
27	<i>Halcyon smyrnensis</i>	White Throated Kingfisher	Alcedinidae	Least Concern	
28	<i>Ardea purpurea</i>	Purple Heron	Ardeidae	Least Concern	
29	<i>Pericrocotus flammeus</i>	Scarlet Minivet	Campephagidae	Least Concern	
30	<i>Alcedo atthis</i>	Small Blue Kingfisher	Alcedinidae	Least Concern	
31	<i>Artamus fuscus</i>	Ashy woodswallow	Artamidae	Least Concern	
32	<i>Pycnonotus cafer</i>	Red vented Bulbul	Pycnonotidae	Least Concern	
33	<i>Dicrurus paradiseus</i>	Racket tailed drongo	Dicruridae	Least Concern	
34	<i>Surniculus lugubris</i>	Drongo Cuckoo	Cuculidae	Least Concern	
35	<i>Cuculus canorus</i>	Common Cuckoo	Cuculidae	Least Concern	
36	<i>Ardea cinerea</i>	Grey Heron	Ardeidae	Least Concern	
37	<i>Pernis ptilorhynchus</i>	Oriental Honey Buzzard	Accipitridae	Least Concern	

38	<i>Oriolus oriolus</i>	Golden Oriole	Oriolidae	Least Concern	Winter Visitor
39	<i>Dendrocitta vagabunda</i>	Indian Treepie	Corvidae	Least Concern	
40	<i>Centropus bengalensis</i>	Lesser Coucal	Cuculidae	Least Concern	
41	<i>Hierococcyx sparverioides</i>	Large Hawk Cuckoo	Cuculidae	Least Concern	
42	<i>Cuculus micropterus</i>	Indian Cuckoo	Cuculidae	Least Concern	
43	<i>Columba livia</i>	Blue Rock Pigeon	Pteroclididae	Least Concern	
44	<i>Pericrocotus cinnamomeus</i>	Small Minivet	Campephagidae	Least Concern	
45	<i>Streptopelia chinensis</i>	Spotted dove	Columbidae	Least Concern	
46	<i>Pycnonotus jocosus</i>	Red Whiskered Bulbul	Pycnonotidae	Least Concern	
47	<i>Phylloscopus trochiloides</i>	Greenish Warbler	Muscicapidae	Least Concern	Winter Visitor
48	<i>Hierococcyx varius</i>	Common Hawk Cuckoo	Cuculidae	Least Concern	
49	<i>Accipiter badius</i>	Shikra	Accipitridae	Least Concern	
50	<i>Egretta garzetta</i>	Little Egret	Ardeidae	Least Concern	
51	<i>Circus melanoleucos</i>	Pied Harrier	Accipitridae	Least Concern	
52	<i>Lonchura kelaarti</i>	Black-throated Munia	Estrildidae	Least Concern	
53	<i>Motacilla indica</i>	Forest wagtail	Motacillidae	Least Concern	Winter Visitor
54	<i>Hirundo rustica</i>	Barn Swallow	Hirundinidae	Least Concern	Winter Visitor
55	<i>Sturnus roseus</i>	Rosy starling	Sturnidae	Least Concern	Winter Visitor
56	<i>Aegithia tiphia</i>	Common Iora	Irenidae	Least Concern	
57	<i>Vanellus indicus</i>	Red-wattled-lapwing	Charadriidae	Least Concern	
58	<i>Prinia socialis</i>	Ashy Prinia	Cisticolidae	Least Concern	
59	<i>Coracina javensis</i>	Large Cuckooshrike	Campephagidae	Least Concern	

60	<i>Aviceda leuphotes</i>	Black Baza	Accipitridae	Least Concern	
61	<i>Hemiprocne coronata</i>	Crested Treeswift	Apodidae	Least Concern	
62	<i>Dicrurus macrocercus</i>	Black Drongo	Dicruridae	Least Concern	
63	<i>Treron pompadora affinis</i>	Pompadour Green Pigeon	Columbidae	Least Concern	
64	<i>Zoothera citrina</i>	White throated ground thrush	Muscicapidae	Least Concern	
65	<i>Anas crecca</i>	Common Teal	Anatidae	Least Concern	
66	<i>Turdoides striatus</i>	Jungle Babbler	Muscicapidae	Least Concern	
67	<i>Otus sunia</i>	Oriental Scops Owl	Strigidae	Least Concern	
68	<i>Athene brama</i>	Spotted owlet	Strigidae	Least Concern	
69	<i>Clamator jacobinus</i>	Pied Crested Cuckoo	Cuculidae	Least Concern	
70	<i>Casmerodius albus</i>	Large Egret	Ardeidae	Least Concern	
71	<i>Tyto alba</i>	Barn Owl	Strigidae	Least Concern	
72	<i>Amaurornis phoenicurus</i>	White Breasted Water Hen	Rallidae	Least Concern	
73	<i>Micropternus brachyurus</i>	Rufous Woodpecker	Picidae	Least Concern	
74	<i>Psilopogon zeylanicus</i>	Brown-headed Barbet	Ramphastidae	Least Concern	
75	<i>Nectarinia zeylonica</i>	Purple-rumped Sunbird	Nectariniidae	Least Concern	
76	<i>Tephrodornis pondicerianus</i>	Common Woodshrike	Vangidae	Least Concern	
77	<i>Dendrocygna javanica</i>	Lesser Whistling Duck	Anatidae	Least Concern	
78	<i>Loriculus vernalis</i>	Indian Hanging Parrot	Psittacidae	Least Concern	
79	<i>Megalaima viridis</i>	White cheeked barbet	Capitonidae	Least Concern	
80	<i>Leptocoma minima</i>	Crimson-backed Sunbird	Nectariniidae	Least Concern	Endemic

81	<i>Streptopelia senegalensis</i>	Laughing Dove	Columbidae	Least Concern	
82	<i>Treron bicinctus</i>	Orange-breasted Green Pigeon	Columbidae	Least Concern	
83	<i>Copsychus saularis</i>	Oriental magpie robin	Muscicapidae	Least Concern	
84	<i>Lonchura punctulata</i>	Scaly-breasted Munia	Estrildidae	Least Concern	
85	<i>Argya subrufa</i>	Rufous Babbler	Leiothrichidae	Least Concern	
86	<i>Vanellus indicus</i>	Red-wattled-lapwing	Charadriidae	Least Concern	
87	<i>Eudynamis scolopacea</i>	Asian Koel	Cuculidae	Least Concern	
88	<i>Aegithia tiphia</i>	Common Iora	Irenidae	Least Concern	
89	<i>Anthus rufulus</i>	Paddy field Pipit	Motacillidae	Least Concern	
90	<i>Elanus caeruleus</i>	Black-winged Kite	Accipitridae	Least Concern	
91	<i>Pitta brachyura</i>	Indian pitta	Pittidae	Least Concern	Winter Visitor
92	<i>Pericrocotus flammeus</i>	Orange minivet	Campephagidae	Least Concern	
93	<i>Galloperdix lunulata</i>	Painted Spurfowl	Phasianidae	Least Concern	Endemic
94	<i>Cypsiurus balasiensis</i>	Asian Palm Swift	Apodidae	Least Concern	
95	<i>Ficedula parva</i>	Red-breasted Flycatcher	Muscicapidae	Least Concern	
96	<i>Pavo cristatus</i>	Indian peafowl	Phasianidae	Least Concern	

List of Amphibians

SN	Scientific Name	Common Name	IUCN Status
1	<i>Hoplobatrachus tigerinus</i>	Indian bullfrog	Least Concern
2	<i>Duttaphrynus melanostictus</i>	Indian common toad	Least Concern
3	<i>Polypedates leucomystax</i>	Common Tree Frog	Least Concern
4	<i>Polypedates pseudocruciger</i>	False Hour-glass Tree Frog	Least Concern
5	<i>Euphlyctis cyanophlyctis</i>	Indian skipper frog	Least Concern
6	<i>Ichthyophis beddomei</i>	Beddome's Caecilian	Least Concern

7	<i>Rhacophorus malabaricus</i>	Malabar gliding frog	Least Concern
8	<i>Euphlyctis hexadactylus</i>	Green Pond Frog	Least Concern
9	<i>Duttaphrynus scaber</i>	Ferguson's Toad	Least Concern
10	<i>Sphaerotheca breviceps</i>	Indian Burrowing Frog	Least Concern
11	<i>Zakerana keralensis</i>	Kerala Warty Frog	Least Concern
12	<i>Raorchestes anili</i>	Anil's Bush Frog	Least Concern
13	<i>Zakerana rufescens</i>	Rufescent Burrowing Frog	Least Concern

List of Odonates

SN	Scientific Name	Common Name
1	<i>Hydrobacsileus croceus</i>	Amber-winged Marsh Glider
2	<i>Disparoneura quadrimaculata</i>	Black-winged bambootail
3	<i>Diplacodes trivialis</i>	Ground Skimmer
4	<i>Rhyothemis vareiegata</i>	Common Picture Wing
5	<i>Ictinogomphus rapax</i>	Common Clubtail
6	<i>Orthetrum sabina</i>	Green Marsh Hawk
7	<i>Gynacantha dravida</i>	Brown Darner
8	<i>Pseudagrion microcephalum</i>	Blue Grass Dart
9	<i>Potamarcha congener</i>	Yellow-Tailed Ashy Skimmer
10	<i>Acisoma panorpoides</i>	Asian Pintail
11	<i>Vestalis apicalis</i>	Black-tipped forest glory
12	<i>Bradinopyga geminata</i>	Granite Ghost
13	<i>Neurothemis tullia</i>	Pied Paddy Skimmer
14	<i>Agriocnemis pygmaea</i>	Pygmy Dartlet
15	<i>Orthetrum glaucaum</i>	Brown Backed Red Marsh Hawk
16	<i>Pseudagrion microcephalum</i>	Blue Grass Dart
17	<i>Pantala flavescens</i>	Wandering Glider
18	<i>Brachythemis contaminata</i>	Ditch Jewel
19	<i>Lathrecista asiatica</i>	Asiatic Bloodtail
20	<i>Ceriagrion coromandelianum</i>	Coromandel Marsh Dart

21	<i>Orthetrum taeniolatum</i>	Asian freshwater dragonfly
22	<i>Brachydiplax chalybea</i>	Rufous Backed Marsh Hawk
23	<i>Urothemis signata</i>	Greater Crimson Glider
24	<i>Ceriagrion cerinorubellum</i>	Orange-Tailed Marsh Dart
25	<i>Rhodothemis rufa</i>	Rufous Marsh Glider
26	<i>Copera marginipes</i>	Yellow bush dart
27	<i>Crocothemis servilia</i>	Ruddy Marsh Skimmer
28	<i>Aethriamanta brevipennis</i>	Scarlet Marsh Hawk

List of Butterflies

SN	Common Name	Scientific Name	Status
Papilionidae			
1	Common Bluebottle	<i>Graphium sarpedon</i> Linnaeus	
2	Tailed Jay	<i>Graphium agamemnon</i> Linnaeus	
3	Common Mime	<i>Papilio clytia</i> Linnaeus	
4	Southern Birdwing	<i>Troides minos</i> Cramer	Endemic to W.Ghats
5	Blue Mormon	<i>Papilio polymnestor</i>	
6	Common Mormon	<i>Papilio polytes</i> Linnaeus	
7	Crimson Rose	<i>Pachliopta hector</i> Linnaeus	
8	Common jay	<i>Graphium doson</i>	
9	Lime Butterfly	<i>Papilio demoleus</i> Linnaeus	
Pieridae			
10	Three-spot Grass Yellow	<i>Eurema blanda</i> Boisduval	
11	Great Orange Tip	<i>Hebemoia glaucippe</i> Linnaeus	
12	Psyche	<i>Leptosia nina</i> Fabricius	
13	Common Grass Yellow	<i>Eurema hecabe</i> Linnaeus	
14	Mottled Emigrant	<i>Catopsilia pyranthe</i>	
15	Common Emigrant.	<i>Catopsilia pomona</i> Fabricius	
17	Common Jezebel	<i>Delias eucharis</i> Drury	
18	Common wanderer	<i>Pareronia hippia</i>	
19	Yellow orange tip	<i>Ixias pyrene</i>	
Nymphalidae			

20	Common Five-ring	<i>Ypthima baldus</i> Fabricius	
21	Common Leopard	<i>Phalanta phalantha</i> Drury	
22	Plain Tiger	<i>Danaus chrysippus</i> Linnaeus	
23	Clipper	<i>Parthenos sylvia</i> Cramer	
24	Common Crow	<i>Euploea core</i> Stoll	
25	Glassy Blue Tiger	<i>Parantica aglea</i> Stoll	
26	Rustic	<i>Cupha erymanthis</i> Drury	
27	Nigger	<i>Orsotriaena medus</i> Fabricius	
28	Common Four-ring	<i>Ypthima huebneri</i> Kirby	
29	Common Bushbrown	<i>Mycalesis perseus</i> Fabricius	
30	Brown King Crow	<i>Euploea klugii</i>	
31	Chocolate Pansy	<i>Junonia iphita</i> Cramer	
32	Dark Evening Brown	<i>Melanitis phedima</i> Stoll	
33	Commander	<i>Limenitis procris</i> Cramer	
34	Striped Tiger	<i>Danaus genutia</i> Cramer	
35	Double Brand Crow	<i>Euploea sylvester</i>	
36	Danaid eggfly	<i>Hypolimnas misippus</i>	
37	Dark Brand Bushbrown	<i>Mycalesis mineus</i>	
38	Common Palmfly	<i>Elymnias hypermnestra</i> Linnaeus	
39	Great evening brown	<i>Melanitis zitenius</i>	
40	Blue Tiger	<i>Tirumala limniace</i> Cramer	
41	Angled Castor	<i>Ariadne ariadne</i> Linnaeus	
42	Dark blue tiger	<i>Tirumala septentrionis</i>	
43	Common Sailer	<i>Neptis hylas</i> Linnaeus	
44	Common Baron	<i>Euthalia aconthea</i> Cramer	
45	Common Nawab	<i>Polyura athamas</i>	
46	Lemon Pansy	<i>Junonia lemonias</i> Linnaeus	
47	Common Evening Brown.	<i>Melanitis leda</i> Linnaeus	
48	Grey Pansy	<i>Junonia atlites</i> Linnaeus	
49	Great Eggfly	<i>Hypolimnas bolina</i> Linnaeus	
	Lycanidae		
50	Tiny Grass Blue	<i>Zizula hylax</i> Fabricius	

51	Common Pierrot	<i>Castalius rosimon</i> Fabricius	
52	Small grass jewel	<i>Freyeria putli</i>	
53	Common Cerulean	<i>Jamides celeno</i> Cramer	
54	Red Spot	<i>Zesius chrysomallus</i> Hiibner	
55	Red Pierrot	<i>Talicara nyseus</i> Guerin-Meneville	
56	Monkey Puzzle	<i>Rathinda amor</i> Fabricius	
57	Indian cupid	<i>Everes lacturnus</i>	
58	Common imperial	<i>Cheritra freja</i>	
59	Yamfly	<i>Loxura atymnus</i> Stoll	
60	Lesser Grass Blue	<i>Zizina otis</i>	
61	Common Line-blue	<i>Prosotas nora</i> C. Felder	
62	Gram Blue	<i>Euchrysops cnejus</i>	
63	Quaker	<i>Neopithecops zalmora</i> Butler	
64	Lime blue	<i>Chilades lajus</i>	
65	Indian Sunbeam	<i>Curetis thetis</i> Drury	
66	Plains Cupid	<i>Chilades pandava</i> Horsfield	
67	Banded Blue Pierrot	<i>Discolampa ethion</i> Westwood	
	Hesperiidae		
68	Small Branded Swift	<i>Pelopidas mathias</i>	
69	Blank Swift	<i>Caltoris kumara</i> Moore	
70	Giant Red-eye	<i>Gangara thyrsis</i> Fabricius	
71	Straight Swift	<i>Parnara bada</i> Moore	
72	Dark Palm Dart	<i>Telicota ancilla</i> Herrich-Schaffer	
73	Common Awl	<i>Hasora badra</i> Moore	
74	Common Small Flat	<i>Sarangesa dasahara</i> Moore	
75	Suffused Snow Flat	<i>Tagiades gana</i> Moore	
76	Water Snow Flat	<i>Tagiades litigiosa</i> MOschler	
77	Grass Demon	<i>Udaspes folus</i> Cramer	
78	Indian Palm Bob	<i>Suastus gremius</i> Fabricius	

List of Spiders

Sl. No.	Family	Species Name
1	Salticidae	<i>Phintella vittata</i>
2	Oxyopidae	<i>Peucetia viridana</i>
3	Pisauridae	<i>Pardosa psedoannulata</i>
4	Araneidae	<i>Gasteragnatha germinate</i>
5	Araneidae	<i>Cyclosa confraga</i>
6	Lycosidae	<i>Hippasa agelenoides</i>
7	Salticidae	<i>Menemerus bivittatus</i>
8	Thomisidae	<i>Camarius formosus</i>
9	Salticidae	<i>Telamonia dimidiata</i>
10	Tetragnathidae	<i>Teragnatha mandibulata</i>
11	Hersilidae	<i>Hersilla savignyi</i>
12	Pholcidae	<i>Crossopriza lyoni</i>
13	Sparassidae	<i>Heteropoda lunula</i>
14	Araneidae	<i>Argiope anasuja</i>
15	Sparassidae	<i>Heteropoda venatoria</i>
16	Clubionidae	<i>Clubiona drassodes</i>
17	Salticidae	<i>Hasarius adansoni</i>
18	Araneidae	<i>Argiope pulchella</i>
19	Salticidae	<i>Plexippus paykulli</i>
20	Oxyopidae	<i>Oxyopes baramanicus</i>
21	Salticidae	<i>Plexippus petersi</i>
22	Oxyopidae	<i>Oxyopes javanus</i>
23	Thomisidae	<i>Oxytate virens</i>
24	Araneidae	<i>Eriovixia laglasei</i>
25	Theridiidae	<i>Achaearanea mundula</i>

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GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
INDIA METEOROLOGICAL DEPARTMENT

**CLIMATOLOGICAL TABLES
OF
OBSERVATORIES IN INDIA
1991-2020**

ISSUED BY

OFFICE of HEAD, CLIMATE RESEARCH & SERVICES
INDIA METEOROLOGICAL DEPARTMENT
PUNE - 411005

जलवायवी सारणी १९९१-२०२०

CLIMATOLOGICAL TABLE 1991-2020

स्टेशन : कोझिकोड
STATION : KOZHIKODE

अक्षांश
LAT.

11° 15'

देशांतर
LONG.

75° 47'

माध्य समुद्र तल से ऊँचाई
HEIGHT ABOVE M.S.L.

5.03

मीटर
METRES

प्रेक्षणों पर आधारित
BASED ON OBSERVATIONS

1991-2020

माह	स्टेशन का सतह दाब	वायु तापमान										आर्द्रता		मेघ की मात्रा		मासिक योग	वर्षा के दिनों की संख्या	वर्षसहित सबसे नम महीने का योग	सबसे शुष्क महीने का योग	24 घंटे की सबसे भारी वर्षा	दिनांक और वर्ष	माध्य पवन गति
		माध्य					चरम					सापेक्ष आर्द्रता	वाष्प दाब	समस्त मेघ	निम्न मेघ							
		शुष्क बल्ब	नम बल्ब	दैनिक अधिकतम	दैनिक न्यूनतम	माह में उच्चतम	माह में निम्नतम	उच्चतम	दिनांक और वर्ष	निम्नतम	दिनांक और वर्ष											
MONTH	STATION LEVEL PRESSURE	AIR TEMPERATURE						EXTREMES				HUMIDITY		CLOUD AMOUNTS		RAINFALL					MEAN WIND SPEED	
		DRY BULB	WET BULB	DAILY MAX	DAILY MIN	HIGHEST IN THE MONTH	LOWEST IN THE MONTH	HIGHEST	DATE AND YEAR	LOWEST	DATE AND YEAR	RELATIVE HUMIDITY	VAPOUR PRESSURE	ALL CLOUDS	LOW CLOUDS	MONTHLY TOTAL	NO. OF DAYS	TOTAL IN WETTEST MONTH WITH YEAR	TOTAL IN DRIEST MONTH WITH YEAR	HEAVIEST FALL IN 24 HOURS		DATE AND YEAR
	एच.पी.ए hPa	डि. सें. °C	डि. सें. °C	डि. सें. °C	डि. सें. °C	डि. सें. °C	डि. सें. °C	डि. सें. °C		डि. सें. °C		प्रतिशत %	एच.पी.ए. hPa	आकाश के अष्टमांश Oktas of sky	मि.मी. mm		मि.मी. mm	मि.मी. mm	मि.मी. mm		कि.मी.प्र.घ. Kmph	
जनवरी JAN	I 1013.0 II 1009.1	24.7 30.3	22.0 25.2	33.0	23.1	34.2	21.0	36.5	30 2017	17.6	17 1972	77 64	24.3 27.9	1.8 1.8	0.6 0.4	1.6	0.1	116.6 1909	0.0	104.4	3 1909	6.7
फरवरी FEB	I 1012.5 II 1008.6	26.0 30.9	23.2 25.8	33.5	24.1	34.8	22.1	37.6	20 2016	16.1	25 1925	78 65	26.3 29.1	1.8 1.7	0.7 0.6	4.8	0.3	150.1 1945	0.0	150.1	17 1945	7.5
मार्च MAR	I 1011.5 II 1007.6	28.0 31.5	25.1 26.9	34.2	25.7	35.3	23.8	38.6	14 2016	19.4	1 1896	77 68	29.5 31.7	2.1 2.5	0.8 1.2	14.6	1.0	266.5 2008	0.0	125.8	21 2008	8.2
अप्रैल APR	I 1010.2 II 1006.5	29.1 31.9	26.0 27.5	34.4	26.5	35.6	23.5	39.1	29 2016	21.0	20 1989	77 70	31.1 33.3	3.4 4.1	1.3 2.0	83.5	4.1	516.6 1899	0.0	171.6	13 2001	8.4
मई MAY	I 1008.9 II 1006.0	28.8 31.2	26.2 27.5	33.7	26.3	35.4	23.3	39.2	1 2016	20.0	24 1937	80 74	31.9 33.8	4.7 5.2	1.8 2.2	223.5	9.0	1021.8 1932	16.2 1923	468.6	19 1882	8.3
जून JUN	I 1008.5 II 1006.5	26.4 28.3	25.3 26.2	30.6	24.4	33.8	22.6	36.2	1 2015	20.6	30 1956	91 84	31.3 32.4	6.3 6.6	2.9 3.1	782.9	23.1	1384.5 1954	215.4 1976	250.2	10 1941	7.3
जुलाई JUL	I 1009.1 II 1007.1	25.4 27.3	24.7 25.6	29.6	23.8	32.3	22.2	35.7	4 2018	20.5	9 1986	93 87	30.5 31.6	6.6 6.7	3.0 3.0	750.0	24.3	1750.7 1968	179.3 1918	283.2	17 2009	6.1
अगस्त AUG	I 1009.8 II 1007.5	25.6 27.5	24.7 25.6	29.8	24.0	32.2	22.5	35.1	31 2015	20.6	11 1950	92 85	30.4 31.5	6.1 6.3	2.6 2.6	432.6	19.1	1267.2 1931	100.8 1887	204.5	11 1924	6.0
सितम्बर SEP	I 1010.3 II 1007.5	26.2 28.4	24.9 25.9	30.9	24.3	32.8	22.8	35.7	6 2015	21.1	30 1954	88 81	30.3 31.3	5.1 5.7	2.1 2.3	273.3	12.3	758.6 2020	6.9 1911	230.3	22 1986	6.7
अक्टूबर OCT	I 1010.8 II 1007.7	26.5 29.0	24.9 26.0	31.8	24.4	33.7	22.7	36.2	20 2015	18.6	18 1984	87 78	30.2 31.4	4.8 5.8	1.9 2.6	302.6	11.6	800.2 1962	26.2 2016	236.6	25 2008	6.3
नवम्बर NOV	I 1011.2 II 1008.0	26.4 29.7	24.4 26.0	32.6	24.3	34.2	22.3	36.8	22 2017	16.1	27 1901	83 73	28.9 30.6	4.0 4.8	1.4 2.0	120.4	6.0	469.8 1978	0.0	192.3	11 1925	5.8
दिसम्बर DEC	I 1012.4 II 1008.8	25.1 30.1	22.5 25.2	32.9	23.2	34.3	20.8	37.0	11 2015	16.1	12 1895	78 66	25.2 28.2	2.6 3.1	0.8 1.0	21.9	1.5	183.0 1942	0.0	115.1	8 1942	5.9
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I 1010.7 II 1007.6	26.5 29.7	24.5 26.1	32.3	24.5	36.0	20.4	39.2	1 2016	16.1	25 1925	83 75	29.2 31.1	4.1 4.5	1.7 1.9	3011.9	112.3	4962.3 1961	1792.4 2016	468.6 5	19 1882	6.9

स्टेशन : कोझिकोड
STATION : KOZHIKODE

राज्य : केरल
STATE : KERALA

सूचकांक : 43314
INDEX NO. :

मौसम परिघटना							पवन														मेघ										दृश्यता					
के साथ दिनों की संख्या							पवन की गति (कि.मी.प्र.घं.) का माह में दिनों की संख्या				पवन की दिशा के दिनों की संख्या का प्रतिशत										मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्टमांश					निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्टमांश					दृश्यता सहित दिनों की संख्या					
माह	वर्षाण 0.3 मि.मी.या अधिक	ओले	गर्जन	कुहरा	धूल भरी अंधी	चंड वात	62 या अधिक	20-61	1-19	0	उ	उपू	पू	दपू	द	दप	प	उप	शांत	0	1-2	3-5	6-7	8	0	1-2	3-5	6-7	8	कुहरा 8	1 कि.मी. तक	1-4 कि.मी.	4-10 कि.मी.	10-20 कि.मी.	20 कि.मी. से अधिक	
WEATHER PHENOMENA							WIND														CLOUD										VISIBILITY					
No. OF DAYS WITH							NO. OF DAYS WITH WIND SPEED (Kmph)				PERCENTAGE NO. OF DAYS WIND FROM										NO. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS					NO. OF DAYS WITH LOW CLOUD AMOUNT OKTAS					NO. OF DAYS WITH VISIBILITY					
MONTH	PPT 0.3 mm OR MORE	HAIL	THUN DER	FOG	DUST STORM	SQUALL	62 OR MORE	20-61	1-19	0	N	NE	E	SE	S	SW	W	NW	CALM	0	1-2	3-5	6-7	8	0	1-2	3-5	6-7	8	FOG 8	UPTO 1 Km.	1-4 Kms.	4-10 Kms.	10-21 Kms.	OVER 20 Kms.	
जनवरी JAN	I 0.3	0	0.1	0	0	0	0	0	24	7	1	6	55	11	1	1	2	0	23	12	10	7	2	0	19	10	2	0	0	0	0	0	0	2.2	28.8	0
	II 0						0	0	28	3	3	0	0	0	0	4	49	35	9	13	9	7	2	0	21	9	1	0	0	0	0	0	0	0.2	30.8	0
फरवरी FEB	I 0.9	0	0.3	0	0	0	0	0	21	7	3	8	49	10	1	0	2	1	26	11	8	7	2	0	17	9	2	0	0	0	0	0	0	1.3	26.7	0
	II 0						0	2	25	1	2	0	0	0	0	5	46	42	5	11	9	6	2	0	16	10	2	0	0	0	0	0	0.2	27.8	0	
मार्च MAR	I 1.8	0	1.1	0	0	0	0	0	21	10	7	13	32	7	1	1	2	4	33	10	9	8	3	1	15	13	3	0	0	0	0	0	1.2	29.8	0	
	II 0						0	2	28	1	3	0	0	0	0	3	41	48	5	6	11	10	3	1	10	16	5	0	0	0	0	0.2	30.8	0		
अप्रैल APR	I 7.1	0	6.5	0	0	0	0	0	18	12	10	11	18	4	1	1	3	9	43	4	9	10	5	2	8	17	5	0	0	0	0	0	1.9	28.1	0	
	II 0						0	2	27	1	2	1	1	0	0	4	49	40	3	1	6	15	6	2	2	19	9	0	0	0	0	1.2	28.8	0		
मई MAY	I 12.5	0.1	9.5	0	0	0	0	0	20	11	13	9	13	5	1	3	4	16	36	1	6	11	8	5	3	19	9	0	0	0	0	0	3.8	27.2	0	
	II 0						0	3	26	2	4	2	2	1	1	8	39	37	6	0	3	13	10	5	1	18	12	0	0	0	0	0.1	3.3	27.6	0	
जून JUN	I 26.5	0	6.5	0	0	0	0	1	17	12	4	8	17	6	1	6	10	8	40	0	1	8	10	11	1	11	17	1	0	0	0	0.2	10.6	19.2	0	
	II 0						0	3	22	5	4	4	3	1	1	16	30	23	18	0	1	5	10	14	0	9	20	1	0	0	0.4	10	19.6	0		
जुलाई JUL	I 27.7	0	2.2	0	0	0	0	0	17	14	7	8	10	3	1	5	9	11	46	0	1	6	9	15	0	10	20	1	0	0	0	0.3	12.5	18.1	0	
	II 0						0	1	23	7	8	3	2	0	0	9	26	29	23	0	1	5	11	14	0	11	19	1	0	0	0.2	10.5	20.3	0		
अगस्त AUG	I 23.8	0	1.5	0	0	0	0	0	17	14	8	6	7	2	1	5	9	16	46	0	2	9	10	10	1	14	16	0	0	0	0	0.2	10.3	20.5	0	
	II 0						0	0	27	4	6	1	1	0	1	8	32	36	15	0	1	8	11	11	0	14	17	0	0	0	0.1	7.6	23.3	0		
सितम्बर SEP	I 16.4	0	3.2	0	0	0	0	0	17	13	7	6	11	4	1	3	8	14	46	0	4	12	8	6	2	18	10	0	0	0	0	0.1	6.3	23.6	0	
	II 0						0	1	25	4	5	1	0	1	1	12	34	33	13	0	3	9	11	7	1	17	12	0	0	0	0.1	5.1	24.8	0.1		
अक्तूबर OCT	I 16.4	0	10.3	0	0	0	0	0	19	12	3	8	30	9	1	3	3	3	40	1	5	11	9	5	3	19	9	0	0	0	0.1	5.1	25.8	0		
	II 0						0	0	26	5	4	2	3	2	2	16	34	21	16	1	2	9	12	7	1	14	16	0	0	0	0	0	6.3	24.7	0	
नवम्बर NOV	I 8.7	0	7.3	0	0	0	0	0	20	10	0	9	45	10	1	1	1	1	32	3	7	11	6	3	7	18	5	0	0	0	0.1	3	26.9	0		
	II 0						0	0	25	5	3	3	3	2	2	13	37	21	16	2	4	10	9	5	4	16	10	0	0	0	0.1	3.9	26.1	0		
दिसम्बर DEC	I 2.6	0	1.3	0	0	0	0	0	23	8	1	7	56	9	0	0	1	0	26	8	9	9	4	1	16	13	2	0	0	0	2.3	28.7	0			
	II 0						0	0	27	4	2	1	1	1	1	9	47	25	13	7	8	8	6	2	13	14	4	0	0	0	1.1	29.9	0			
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I 144.6	0.1	49.7	0	0	0	0	1	233	131	5	8	29	7	1	2	4	7	37	49	72	106	77	61	92	171	99	3	0	0	1	60.7	303.3	0		
	II 0						0	14	309	42	4	1	1	1	1	9	38	33	12	39	58	106	94	68	70	168	124	3	0	0	0.9	49.5	314.5	0.1		

जलवायवी सारणी १९९१-२०२०

CLIMATOLOGICAL TABLE 1991-2020

स्टेशन : कोझिकोड (A)
STATION : KOZHIKODE (A)

अक्षांश
LAT.

11° 8'

देशांतर
LONG.

75° 57'

माध्य समुद्र तल से ऊँचाई
HEIGHT ABOVE M.S.L.

106.9

मीटर
METRES

प्रेक्षणों पर आधारित
BASED ON OBSERVATIONS

1991-2020

माह	स्टेशन का सतह दाब	वायु तापमान										आर्द्रता		मेघ की मात्रा		मासिक योग	वर्षा के दिनों की संख्या	वर्षसहित सबसे नम महीने का योग	सबसे शुष्क महीने का योग	24 घंटे की सबसे भारी वर्षा	दिनांक और वर्ष	माध्य पवन गति
		माध्य					चरम					सापेक्ष आर्द्रता	वाष्प दाब	समस्त मेघ	निम्न मेघ							
		शुष्क बल्ब	नम बल्ब	दैनिक अधिकतम	दैनिक न्यूनतम	माह में उच्चतम	माह में निम्नतम	उच्चतम	दिनांक और वर्ष	निम्नतम	दिनांक और वर्ष	सापेक्ष आर्द्रता	वाष्प दाब	समस्त मेघ	निम्न मेघ							
AIR TEMPERATURE												HUMIDITY		CLOUD AMOUNTS		RAINFALL						
MONTH	STATION LEVEL PRESSURE	MEAN						EXTREMES				RELATIVE HUMIDITY	VAPOUR PRESSURE	ALL CLOUDS	LOW CLOUDS	MONTHLY TOTAL	NO. OF DAYS	TOTAL IN WETTEST MONTH WITH YEAR	TOTAL IN DRIEST MONTH WITH YEAR	HEAVIEST FALL IN 24 HOURS	DATE AND YEAR	MEAN WIND SPEED
		DRY BULB	WET BULB	DAILY MAX	DAILY MIN	HIGHEST IN THE MONTH	LOWEST IN THE MONTH	HIGHEST	DATE AND YEAR	LOWEST	DATE AND YEAR	%	hPa	Oktas of sky	mm			mm	mm	mm	mm	
	एच.पी.ए hPa	डि. सें. °C	डि. सें. °C	डि. सें. °C	डि. सें. °C	डि. सें. °C	डि. सें. °C	डि. सें. °C		डि. सें. °C		प्रतिशत %	एच.पी.ए. hPa	आकाश के अष्टमांश Oktas of sky	मि.मी. mm		मि.मी. mm	मि.मी. mm	मि.मी. mm		कि.मी.प्र.घ. Kmph	
जनवरी JAN	I II	1000.9 996.9	24.5 29.7	21.0 23.4	32.9 22.1	34.7 20.2	36.1	31 1998	11.2	27 2003	71 57	22.1 23.8	2.1 1.9	0.5 0.5	3.0	0.2	37.2 2000	0.0	32.4	12 2000	5.7	
फरवरी FEB	I II	1000.4 996.4	25.4 30.3	22.1 23.9	33.6 23.0	36.0 21.1	37.8	25 2010	19.9	12 2011	73 56	24.0 24.4	2.2 1.7	0.7 0.6	3.8	0.4	17.0 2013	0.0	16.1	8 1994	6.1	
मार्च MAR	I II	999.4 995.4	27.4 30.8	24.3 25.2	34.0 24.7	35.8 22.8	37.7	23 1996	21.4	21 2008	76 61	27.9 27.5	2.4 2.5	0.9 1.2	26.6	1.2	264.3 2008	0.0	106.2	21 2008	6.5	
अप्रैल APR	I II	998.2 994.5	28.5 31.0	25.2 26.0	34.0 25.4	35.6 22.1	38.6	5 1998	19.8	28 2008	76 66	29.5 29.6	3.6 4.2	1.3 2.2	84.7	4.2	321.5 2001	0.6 2013	236.7	13 2001	6.6	
मई MAY	I II	997.0 994.2	28.1 30.1	25.3 25.9	32.9 25.1	35.1 21.9	36.8	7 1998	20.8	23 1993	79 70	30.1 30.2	4.8 5.1	1.9 2.5	198.3	8.8	649.1 2004	42.5 1997	206.2	7 2004	6.5	
जून JUN	I II	996.8 994.7	25.8 27.6	24.4 25.1	30.0 23.4	33.0 21.6	35.4	4 1997	20.2	7 2020	88 81	29.4 29.8	6.5 6.5	3.1 3.3	706.6	22.2	1201.3 2013	374.2 2009	244.7	2 2011	5.7	
जुलाई JUL	I II	997.1 995.1	25.1 26.8	23.9 24.6	29.0 22.9	31.2 21.2	32.6	4 1996	19.3	28 2008	90 82	28.7 29.1	6.7 6.7	3.3 3.3	689.4	23.6	1362.6 2007	302.6 2002	220.6	11 1997	5.8	
अगस्त AUG	I II	997.7 995.3	25.2 27.0	24.0 24.5	29.2 23.1	31.2 21.5	32.2	23 2014	19.6	12 2002	89 81	28.8 28.8	6.4 6.4	3.1 3.2	428.2	18.8	1010.1 2019	181.4 2008	210.2	15 2018	6.1	
सितम्बर SEP	I II	998.2 995.3	25.7 27.6	24.1 24.6	30.2 23.3	32.3 21.7	33.6	28 2018	20.6	26 2001	87 77	28.8 28.6	5.7 5.8	2.6 2.7	295.5	13.4	727.3 2006	38.0 2018	150.7	28 1996	5.6	
अक्टूबर OCT	I II	998.8 995.7	25.9 27.9	24.0 24.9	30.9 23.3	33.1 21.6	35.0	29 2009	20.1	26 2019	85 78	28.5 29.2	5.2 5.7	2.1 2.6	321.8	12.6	505.5 1999	112.4 2012	167.6	25 2008	5.2	
नवम्बर NOV	I II	999.2 995.9	25.9 28.6	23.3 24.8	31.9 23.2	33.9 21.4	35.0	3 2009	19.5	17 2007	79 73	26.7 28.3	4.1 4.8	1.4 2.0	134.4	6.6	453.8 1997	21.3 2012	102.2	16 2001	5.0	
दिसम्बर DEC	I II	1000.1 996.6	25.0 29.2	21.5 23.8	32.4 22.4	34.2 20.4	35.6	31 2015	19.3	27 2011	72 62	23.0 25.2	3.0 3.3	0.8 1.1	35.3	1.4	211.1 1996	0.0	129.8	13 1988	5.5	
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I II	998.7 995.5	26.0 28.9	23.6 24.7	31.8 23.5	36.4 19.8	38.6	5 1998	11.2	27 2003	80 70	27.3 27.9	4.4 4.5	1.8 2.1	2927.5	113.4	4272.2 2007	1762.4 2016	244.7 6	2 2011	5.8	

स्टेशन : कोझिकोड (A)
STATION : KOZHIKODE (A)

राज्य : केरल
STATE : KERALA

सूचकांक : 43320
INDEX NO. :

मौसम परिघटना							पवन														मेघ										दृश्यता					
के साथ दिनों की संख्या							पवन की गति (कि.मी.प्र.घं.) का माह में दिनों की संख्या				पवन की दिशा के दिनों की संख्या का प्रतिशत										मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्टमांश					निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्टमांश					दृश्यता सहित दिनों की संख्या					
माह	वर्षाण 0.3 मि.मी.या अधिक	ओले	गर्जन	कुहरा	धूल भरी अंधी	चंड वात	62 या अधिक	20-61	1-19	0	उ	उपू	पू	दपू	द	दप	प	उप	शांत	0	1-2	3-5	6-7	8	0	1-2	3-5	6-7	8	कुहरा 8	1 कि.मी. तक	1-4 कि.मी.	4-10 कि.मी.	10-20 कि.मी.	20 कि.मी. से अधिक	
WEATHER PHENOMENA							WIND														CLOUD										VISIBILITY					
No. OF DAYS WITH							NO. OF DAYS WITH WIND SPEED (Kmph)				PERCENTAGE NO. OF DAYS WIND FROM										NO. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS					NO. OF DAYS WITH LOW CLOUD AMOUNT OKTAS					NO. OF DAYS WITH VISIBILITY					
MONTH	PPT 0.3 mm OR MORE	HAIL	THUN DER	FOG	DUST STORM	SQUALL	62 OR MORE	20-61	1-19	0	N	NE	E	SE	S	SW	W	NW	CALM	0	1-2	3-5	6-7	8	0	1-2	3-5	6-7	8	FOG 8	UPTO 1 Km.	1-4 Kms.	4-10 Kms.	10-21 Kms.	OVER 20 Kms.	
जनवरी JAN	I 0.3	0	0.1	0	0	0	0	0	29	2	0	3	70	20	0	0	0	0	7	6	16	7	2	0	18	12	1	0	0	0	0	0	0.6	30	0.4	0
	II 0						0	0	31	0	1	0	1	1	0	3	59	33	2	8	14	6	3	0	16	14	1	0	0	0	0	0	0	26	5	0
फरवरी FEB	I 0.9	0	0.4	0	0	0	0	0	24	4	1	7	62	14	1	0	0	0	15	5	13	7	3	0	14	12	2	0	0	0	0	0	0.7	27.1	0.2	0
	II 0						0	0	28	0	0	0	0	0	0	2	59	38	1	7	13	6	2	0	13	14	1	0	0	0	0	0	0	21.7	6.2	0
मार्च MAR	I 1.6	0	2	0	0	0	0	0	22	9	3	10	46	6	1	0	1	3	30	4	16	8	3	0	11	18	2	0	0	0	0	0.2	29.8	0.9	0	
	II 0						0	2	29	0	1	0	0	0	0	2	57	40	0	4	15	9	3	0	7	20	4	0	0	0	0	0	21.6	9.4	0	
अप्रैल APR	I 6.8	0	7.4	0	0	0	0	0	18	12	9	12	20	4	1	1	2	10	41	1	9	13	6	1	5	21	4	0	0	0	0	0.1	0.2	28.7	1	0
	II 0						0	2	28	0	2	1	1	0	0	3	57	34	2	0	7	14	8	1	1	18	11	0	0	0	0	0.2	20.8	9.1	0	
मई MAY	I 12.1	0	9.5	0.1	0	0	0	0	20	11	14	8	13	4	2	1	3	19	36	0	6	10	12	3	1	21	9	0	0	0	0	0.7	28.8	1.5	0	
	II 0						0	2	27	2	4	1	1	1	1	5	48	34	5	0	3	12	13	3	0	15	16	0	0	0	0.3	21.6	9	0		
जून JUN	I 25.2	0	6.9	0.2	0	0	0	0	16	14	8	6	11	5	4	4	6	9	47	0	1	5	14	10	0	10	19	1	0	0	0	4	25.1	0.9	0	
	II 0						0	1	24	5	6	2	1	1	2	11	35	26	16	0	0	6	14	10	0	7	22	1	0	0	1.7	24.2	4	0		
जुलाई JUL	I 27	0	1.9	0.3	0	0	0	0	18	13	10	7	4	1	2	3	10	19	44	0	1	4	14	12	0	7	23	1	0	0	0	4.2	26.4	0.4	0	
	II 0						0	1	27	3	7	1	1	0	0	4	38	40	9	0	0	4	16	11	0	7	23	1	0	0	1.7	25.8	3.5	0		
अगस्त AUG	I 23.6	0	1.6	0.2	0	0	0	0	18	13	13	4	2	2	2	3	8	23	43	0	1	5	16	9	0	9	21	1	0	0	0.1	3.7	26.8	0.4	0	
	II 0						0	2	27	2	4	0	0	0	1	3	37	49	6	0	0	6	17	8	0	8	22	1	0	0	1.1	24.7	5.2	0		
सितम्बर SEP	I 17.2	0	3.6	0.5	0	0	0	0	15	15	7	5	8	4	3	2	5	14	52	0	2	9	14	5	0	14	16	0	0	0	0	2.8	26.7	0.5	0	
	II 0						0	1	27	2	3	1	0	1	1	8	45	35	6	0	2	9	15	4	0	12	18	0	0	0	0.9	21.2	7.8	0		
अक्तूबर OCT	I 17	0	10.8	0.9	0	0	0	0	18	13	3	9	30	8	2	1	1	4	42	0	4	10	13	4	2	18	11	0	0	0	0.2	3.4	27.1	0.4	0	
	II 0						0	0	26	5	4	3	2	1	3	11	38	21	17	0	3	9	14	5	0	13	18	0	0	0	1.1	24.9	5	0		
नवम्बर NOV	I 9.2	0	8.1	0.3	0	0	0	0	22	8	1	8	51	11	2	0	0	0	27	1	7	12	9	1	4	21	5	0	0	0	2.1	27.4	0.6	0		
	II 0						0	0	23	7	4	3	2	2	2	7	37	21	22	1	5	10	11	3	3	16	11	0	0	0	1.1	25.6	3.4	0		
दिसम्बर DEC	I 2.8	0	1.4	0	0	0	0	0	28	3	0	4	67	19	1	0	0	0	9	3	11	12	5	0	14	15	2	0	0	0	0.9	29.6	0.4	0		
	II 0						0	0	27	4	2	1	1	4	3	6	46	23	14	3	10	11	6	1	11	16	4	0	0	0	0.3	26.4	4.2	0		
वार्षिक योग या माध्य	I 143.5	0.2	53.7	2.5	0.2	0	0	1	248	116	6	7	32	8	2	1	3	8	33	22	86	99	111	47	70	180	112	3	0	0	0.4	23.4	333.4	7.7	0.1	
ANNUAL TOTAL OR MEAN	II 0						0	13	322	30	3	1	1	1	1	5	47	33	8	24	74	100	121	46	52	161	148	4	0	0	0.2	8.5	284.5	71.8	0	

Sampling methodology followed for Ambient Air Quality monitoring

1. Ambient air quality sampling was done as per CPCB / NABL guidelines.
2. High volume sampler Inlet height was kept minimum 3 mtr above ground level.
3. Sampler was kept sufficiently away from any obstructions like building or trees etc.
4. Sampling flow rate of about 1.1 cu m/min. is maintained.
5. Initial and final weights of two filter papers are included in the report.
6. Field data collected was reported in the data sheet along with monitoring report.
7. Field sampling dates were informed well in advance to depute experts at site during the field sampling / measurement.
8. Hourly reading of flow rate & rota meter reading was taken during sampling.
9. Laboratory analysis of the sample was done as per the CPCB / NABL guidelines with the properly calibrated instruments only and calibration chart was provided for the instruments used.
10. Trained & competent manpower with adequate numbers was provided on site for sampling.
11. For the purposes of selection of sampling locations, wind rose diagram is referred. One sample at core zone, one sampling location is selected in the upwind direction / sensitive receptor (school), two sampling locations are selected at the downwind direction within 2 km from the boundary of mine lease area.



Standards

TEST REPORT

ULR No.:TC1219123000000353F

LRI No.:SEAAL23090887A

Date: 15-09-2023

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CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23090186
Sample Name	Ambient Air	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sampled by	Lab Authorized Sampler	Test Completed on	14-09-2023

DETAILS OF SAMPLING

Sampling Location	Project site	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	69 %
Latitude	11°18'38.61"N	Longitude	76°04'17.69"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	60.4	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	26.9	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	4.44	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	5.21	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.49	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by:



Laiju P N
Laboratory Head
Authorized Signatory

The results are related only to the samples submitted for analysis and this test report shall not be reproduced except in full, without the written approval of the laboratory.

Standards Environmental & Analytical Laboratories

Accreditation & Approval: NABL accredited Testing Laboratory as per ISO/IEC 17025:2017
vide Certificate No. TC - 12191 & "A" Grade Laboratory approved by KSPCB.

'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110
Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No.:TC1219123000000354F

LRI No.:SEAAL23090888A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23090187
Sample Name	Ambient Air	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sampled by	Lab Authorized Sampler	Test Completed on	14-09-2023

DETAILS OF SAMPLING

Sampling Location	Own house of M/s Mukkam properties	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	69 %
Latitude	11°18'45.70"N	Longitude	76°4'0.87"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	44.3	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	20.5	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	4.68	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.21	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by:



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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No.:TC1219123000000356F

LRI No.:SEAAL23090890A

Date: 15-09-2023

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CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23090189
Sample Name	Ambient Air	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sampled by	Lab Authorized Sampler	Test Completed on	14-09-2023

DETAILS OF SAMPLING

Sampling Location	Near Mary Girl High School, Koodaranhi - Maranchatty Rd, Maranchatty	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	69 %
Latitude	11°19' 14.78"N	Longitude	76°3' 33.94"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	56.3	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	25.2	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	4.27	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	4.81	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.37	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by:



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Laboratory Head
Authorized Signatory

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'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110
Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No:TC1219123000000355F

LRI No.:SEAAL23090889A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23090188
Sample Name	Ambient Air	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sampled by	Lab Authorized Sampler	Test Completed on	14-09-2023

DETAILS OF SAMPLING

Sampling Location	Near IHRD College of Applied Science	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	69 %
Latitude	11°18'36.61"N	Longitude	76°3'16.72"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	49.6	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	26.7	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	4.51	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	5.04	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.35	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report



Checked by:



Laiju P N
Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No:TC1219123000000358F

LRI No.:SEAAL23090892A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23090191
Sample Name	Ambient Air	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sampled by	Lab Authorized Sampler	Test Completed on	14-09-2023

DETAILS OF SAMPLING

Sampling Location	Fathimabi Memorial HS School, Koombara	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	69 %
Latitude	11°19' 10.72"N	Longitude	76°4' 38.23"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	35.2	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	16.1	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	4.11	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.19	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by:




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Authorized Signatory



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TEST REPORT

ULR No:TC1219123000000358F

LRI No.:SEAAL23090893A

Date: 15-09-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 07-09-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23090192
Sample Name	Ambient Air	Sample Received on	08-09-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	09-09-2023
Sampled by	Lab Authorized Sampler	Test Completed on	14-09-2023

DETAILS OF SAMPLING

Sampling Location	Government U P School, Chundathupoyil	Date of Sampling	07-09-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	69 %
Latitude	11°17'46.07"N	Longitude	76°4'19.29"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	40.2	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	18.6	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	4.34	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.20	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by: 




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TEST REPORT

ULR No:TC1219123000002719F

LRI No.:SEAAL23100885A

Date: 18-10-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 11-10-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23100208
Sample Name	Ambient Air	Sample Received on	12-10-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	13-10-2023
Sampled by	Lab Authorized Sampler	Test Completed on	17-10-2023

DETAILS OF SAMPLING

Sampling Location	Project site	Date of Sampling	11-10-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	65 %
Latitude	11°18'38.61"N	Longitude	76°04'17.69"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	58.3	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	25.5	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.22	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by: 




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TEST REPORT

ULR No:TC1219123000002721F

LRI No.:SEAAL23100887A

Date: 18-10-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 11-10-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23100210
Sample Name	Ambient Air	Sample Received on	12-10-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	13-10-2023
Sampled by	Lab Authorized Sampler	Test Completed on	17-10-2023

DETAILS OF SAMPLING

Sampling Location	Own house of M/s Mukkam properties	Date of Sampling	11-10-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	65 %
Latitude	11°18'45.70"N	Longitude	76°4'.0.87"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala


TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	43.9	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	21.5	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.18	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report




Laju P N
Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No.:TC1219123000002717F

LRI No.:SEAAL23100883A

Date: 18-10-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 11-10-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23100206
Sample Name	Ambient Air	Sample Received on	12-10-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	13-10-2023
Sampled by	Lab Authorized Sampler	Test Completed on	17-10-2023

DETAILS OF SAMPLING

Sampling Location	Near Mary Girl High School, Koodaranhi - Maranchatty Rd, Maranchatty	Date of Sampling	11-10-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	65 %
Latitude	11°19' 14.78"N	Longitude	76°3' 33.94"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	43.2	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	18.7	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.18	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by:



Laiju P N
Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No.:TC1219123000002720F

LRI No.:SEAAL23100886A

Date: 18-10-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 11-10-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23100209
Sample Name	Ambient Air	Sample Received on	12-10-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	13-10-2023
Sampled by	Lab Authorized Sampler	Test Completed on	17-10-2023

DETAILS OF SAMPLING

Sampling Location	Near IHRD College of Applied Science	Date of Sampling	11-10-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	65 %
Latitude	11°18'36.61"N	Longitude	76°3'16.72"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	49.1	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	24.9	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/m ³	0.19	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by:



Laiju P N
Laboratory Head
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TEST REPORT

ULR No:TC1219123000002716F

LRI No.:SEAAL23100882A

Date: 18-10-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 11-10-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23100205
Sample Name	Ambient Air	Sample Received on	12-10-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	13-10-2023
Sampled by	Lab Authorized Sampler	Test Completed on	17-10-2023

DETAILS OF SAMPLING

Sampling Location	Fathimabi Memorial HS School, Koombara	Date of Sampling	11-10-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	65 %
Latitude	11°19' 10.72"N	Longitude	76°4' 38.23"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE


SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	35.8	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	15.6	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.13	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by: 




Lajju P N
Laboratory Head
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TEST REPORT

ULR No:TC1219123000002718F

LRI No.:SEAAL23100884A

Date: 18-10-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 11-10-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23100207
Sample Name	Ambient Air	Sample Received on	12-10-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	13-10-2023
Sampled by	Lab Authorized Sampler	Test Completed on	17-10-2023

DETAILS OF SAMPLING

Sampling Location	Government U P School, Chundathupoyil	Date of Sampling	11-10-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	65 %
Latitude	11°17'46.07"N	Longitude	76°4'19.29"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	47.6	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	23.2	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.15	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report

Checked by: 




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Laboratory Head
Authorized Signatory

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TEST REPORT

ULR No:TC1219123000003969F

LRI No.:SEAAL23110432A

Date: 07-11-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 03-11-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23110092
Sample Name	Ambient Air	Sample Received on	04-11-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	06-11-2023
Sampled by	Lab Authorized Sampler	Test Completed on	07-11-2023

DETAILS OF SAMPLING

Sampling Location	Project site	Date of Sampling	03-11-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	67 %
Latitude	11°18'38.61"N	Longitude	76°04'17.69"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-Survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE


SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	66.6	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	32.2	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.33	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report



Checked by: 


Laju P N
Laboratory Head
Authorized Signatory

The results are related only to the samples submitted for analysis and this test report shall not be reproduced except in full, without the written approval of the laboratory.

Standards Environmental & Analytical Laboratories

Accreditation & Approval: NABL accredited Testing Laboratory as per ISO/IEC 17025:2017

vide Certificate No. TC - 12191 & "A" Grade Laboratory approved by KSPCB.

'Standards' Bldg. No: 338/A,B,C,D,E (Behind BPCL Petrol Pump), Edayar, Muppathadam P.O., Ernakulam Dist. - 683 110

Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No.:TC1219123000003970F

LRI No.:SEAAL23110433A

Date: 07-11-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 03-11-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23110093
Sample Name	Ambient Air	Sample Received on	04-11-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	06-11-2023
Sampled by	Lab Authorized Sampler	Test Completed on	07-11-2023

DETAILS OF SAMPLING

Sampling Location	Own house of M/s Mukkam properties	Date of Sampling	03-11-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	67 %
Latitude	11°18'45.70"N	Longitude	76°4'0.87"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-Survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	50.7	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	24.8	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.26	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report




Laju P N
Laboratory Head
Authorized Signatory


Checked by:

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No.:TC1219123000003971F

LRI No.:SEAAL23110434A

Date: 07-11-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 03-11-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23110094
Sample Name	Ambient Air	Sample Received on	04-11-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	06-11-2023
Sampled by	Lab Authorized Sampler	Test Completed on	07-11-2023

DETAILS OF SAMPLING

Sampling Location	Near Mary Girl High School, Koodaranhi – Maranchatty Rd, Maranchatty	Date of Sampling	03-11-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	67 %
Latitude	11°19' 14.78"N	Longitude	76°3' 33.94"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-Survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala


TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	47.1	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	22.5	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.25	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report




Laju P N
Laboratory Head
Authorized Signatory

Checked by:

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: sealab@gmail.com

TEST REPORT

ULR No:TC1219123000003972F

LRI No.:SEAL23110435A

Date: 07-11-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 03-11-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23110095
Sample Name	Ambient Air	Sample Received on	04-11-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	06-11-2023
Sampled by	Lab Authorized Sampler	Test Completed on	07-11-2023

DETAILS OF SAMPLING

Sampling Location	Near IHRD College of Applied Science	Date of Sampling	03-11-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	67 %
Latitude	11°18'36.61"N	Longitude	76°3'16.72"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un -Survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE


SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	44.2	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	20.1	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/m ³	0.26	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report



Checked by:



Laju P N
Laboratory Head
Authorized Signatory

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No:TC1219123000003973F

LRI No.:SEAL23110436A

Date: 07-11-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 03-11-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23110096
Sample Name	Ambient Air	Sample Received on	04-11-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	06-11-2023
Sampled by	Lab Authorized Sampler	Test Completed on	07-11-2023

DETAILS OF SAMPLING

Sampling Location	Fathimabi Memorial HS School, Koombara	Date of Sampling	03-11-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	67 %
Latitude	11°19' 10.72"N	Longitude	76°4' 38.23"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un-Survey)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	46.3	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	23.5	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.22	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report



(Signature)

Laiju P N
Laboratory Head
Authorized Signatory

(Signature)
Checked by:

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

TEST REPORT

ULR No.:TC1219123000003974F

LRI No.:SEAL23110437A

Date: 07-11-2023

Page 1 of 1

CUSTOMER DETAILS

Customer Name & Address	M/s Mukkom Property Developers Pvt. Ltd. Kumaranellor, Kozhikode District.
Customer Reference	Test Request date: 03-11-2023

SAMPLE DETAILS

Product Category	Atmospheric Pollution	Sample Code	EN23110097
Sample Name	Ambient Air	Sample Received on	04-11-2023
Sample Conditions at Receipt	Fit for Analysis	Test Commenced on	06-11-2023
Sampled by	Lab Authorized Sampler	Test Completed on	07-11-2023

DETAILS OF SAMPLING

Sampling Location	Government U P School, Chundathupoyil	Date of Sampling	03-11-2023
Sampling Procedure	SEAAL/ENL/GEN/SOP/02	Humidity	67 %
Latitude	11°17'46.07"N	Longitude	76°4'19.29"E

SAMPLING SITE DETAILS

Survey Number	Survey Number (Un- Survey Number)		
Village	Kumaranellor	Taluk	Kozhikode
District	Kozhikode	State	Kerala

TEST RESULTS-CHEMICAL DISCIPLINE

SL NO	PARAMETERS	TEST METHOD	UNIT	RESULT	KSPCB LIMIT
1	Particulate matter PM ₁₀	IS 5182 (Part 23): 2006	µg/m ³	53.2	100 (Max)
2	Particulate matter PM _{2.5}	IS 5182 (Part 24): 2019	µg/m ³	26.8	60 (Max)
3	Sulphur dioxide as SO ₂	IS 5182 (Part 2): 2001	µg/m ³	BDL (LOD4.00)	80 (Max)
4	Oxides of Nitrogen as NO ₂	IS 5182 (Part 6): 2006	µg/m ³	BDL (LOD 4.00)	80 (Max)
5	Carbon monoxide as CO	IS 5182: (Part 10): 1999	mg/ m ³	0.28	4 (Max)
6	Lead as Pb	IS 5182 (Part 22): 2004	µg/m ³	BDL (LOD0.01)	1 (Max)

Remarks:

End of Report




Laju P N
Laboratory Head
Authorized Signatory

Checked by:

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Tel. 0484-2546660, 93872 72402, 90743 41443, Web: www.sealabs.in, E-mail: seaalab@gmail.com

Format

Notice for “Placement for Suitable Posts”

M/s Mukkom Property Developers Pvt. Ltd. is in the process of mining operations building stone minor mineral quarry project at Survey No. (Un survey), Kumaranellor Village, Kozhikode Taluk, Kozhikode District, Kerala for a Mine Lease (ML) area of 8.1765 ha. with annual production of 3,00,000 MT. The company is inviting applications for various posts as mentioned below in the table for the Operational phase of the proposed project. The qualification requirements of each post and other details is available in the website of the company (Website Address.....).

SN	NAME OF THE POST	NOS.
1.	Mine Manager 1 st Class	1
2.	Environment Officer	1
3.	Mechanic (Vehicle and Machinery)	2
4.	Excavator (20 Ton capacity) Operator 1 st shift -(Caterpillar, JCB)	2
5.	Excavator (20 Ton, capacity) Operator 2 nd shift - (Caterpillar, JCB)	2
6.	Excavator (30 Ton, Capacity) Operator 1 st shift - (Caterpillar, JCB)	2
7.	Excavator (30 Ton, Capacity) Operator 2 nd shift - (Caterpillar, JCB)	2
8.	Mines foreman	2
9.	Mines mate	2
10.	Drilling	4
11.	Cleaning – Drilling helper	2
12.	Blasting helpers	2
13.	Quarry in-charge	1
14.	Quarry supervisor	2
15.	Mess (Cook - 1 no. + Helper – 1 no.)	2
16.	Tipper (Taurus) Drivers	6
17.	Tipper cleaners	6
18.	Office staff	4
19.	Helpers and cleaners	3
20.	Security	2
	TOTAL	50

Placement Officer

Modeling Study Report

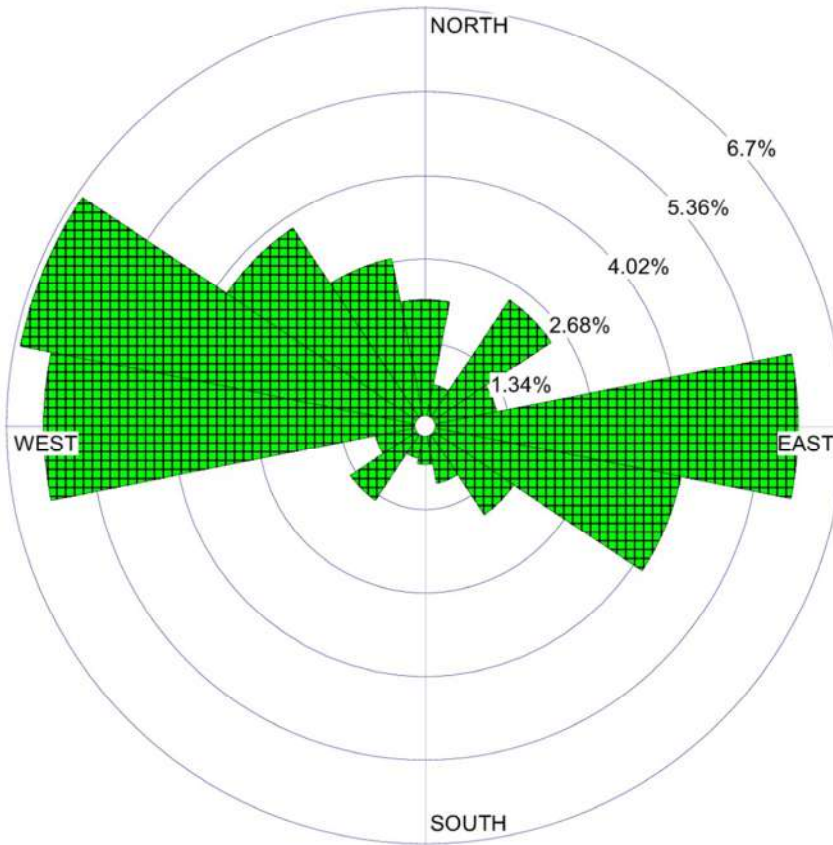
Prepared for
Proposed Quarry of
M/s Mukkom Property Developers Pvt. Ltd
at
Survey No. (Un survey), Kumaranellor Village,
Kozhikode Taluk, Kozhikode District, Kerala
for a Mine Lease (ML) area of 8.1765 ha.

Table : Wind Frequency Distribution

	Directions / Wind Classes (m/s)	0.28 - 1.40	1.40 - 2.80	2.80 - 4.20	>= 4.20	Total
1	N	0.02016	0	0	0	0.02016
2	NNE	0.00672	0	0	0	0.00672
3	NE	0.02419	0	0	0	0.02419
4	ENE	0.01165	0	0	0	0.01165
5	E	0.05959	0	0	0	0.05959
6	ESE	0.04167	0	0	0	0.04167
7	SE	0.01703	0	0	0	0.01703
8	SSE	0.00941	0	0	0	0.00941
9	S	0.00627	0	0	0	0.00627
10	SSW	0.00538	0	0	0	0.00538
11	SW	0.01434	0	0	0	0.01434
12	WSW	0.00806	0	0	0	0.00806
13	W	0.06093	0	0	0	0.06093
14	WNW	0.06586	0	0	0	0.06586
15	NW	0.03808	0	0	0	0.03808
16	NNW	0.02733	0	0	0	0.02733
	Sub-Total	0.41667	0	0	0	0.41667
	Calms					0.58333
	Missing/Incomplete					0
	Total					1

WIND ROSE PLOT:
Station # 12

DISPLAY:
Wind Speed
Direction (blowing from)



WIND SPEED
(m/s)

- >= 4.20
- 2.80 - 4.20
- 1.40 - 2.80
- 0.28 - 1.40

Calms: 58.33%

COMMENTS:

DATA PERIOD:

Start Date: 01-09-2022 - 00:00
End Date: 30-11-2022 - 23:00

COMPANY NAME:

Quarry Project of M/s Mukkom Property Developers Pvt. Ltd.

MODELER:
M/s Environmental Engineers and

CALM WINDS:

58.33%

TOTAL COUNT:

2232 hrs.

AVG. WIND SPEED:

0.22 m/s

DATE:

05-09-2023

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Figure 1 : Wind Rose Diagram of the project site

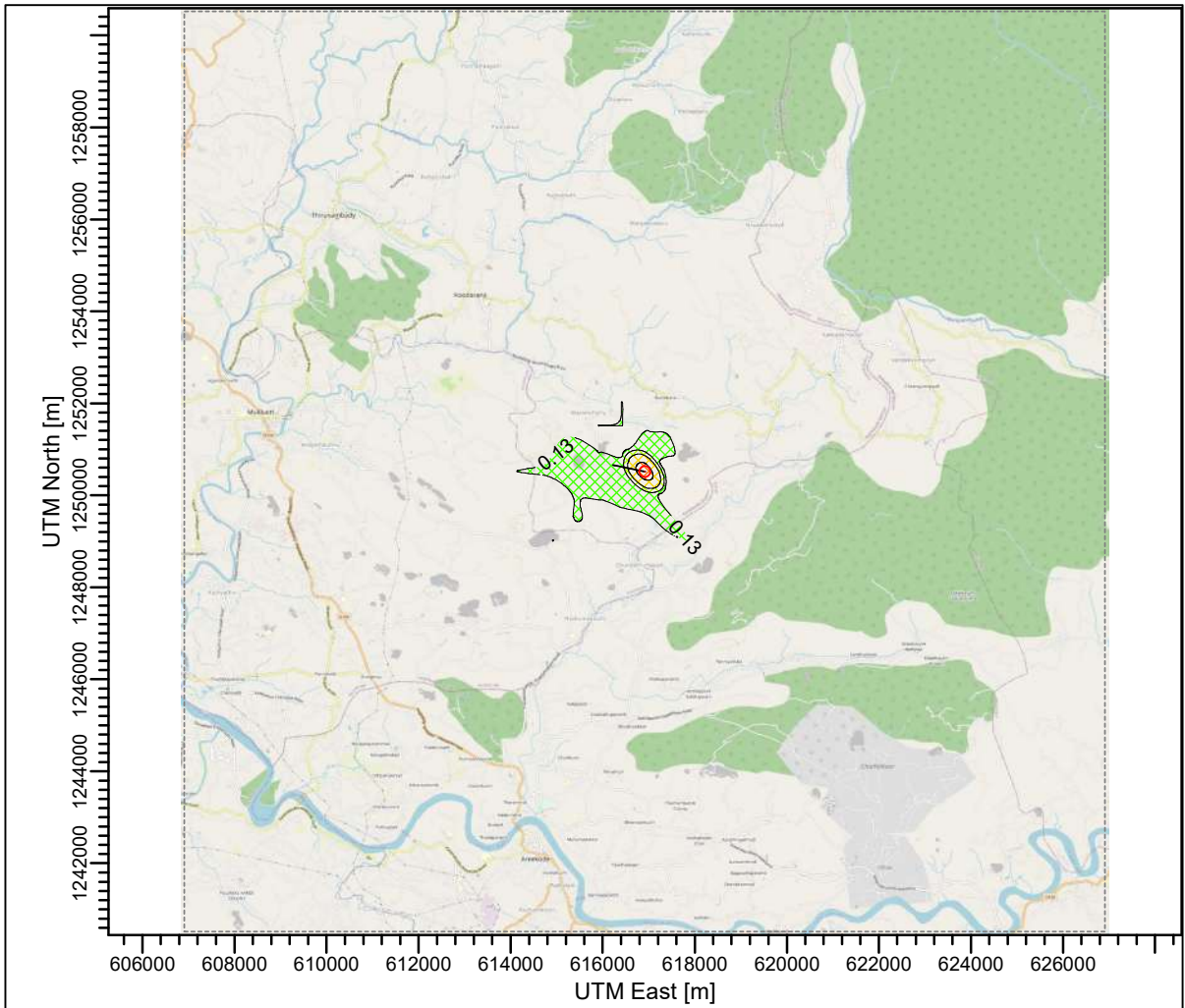
Emission Details

Emission Details	Pollutant, g/sec-m ²	
	PM ₁₀	PM _{2.5}
Mining activity	1.05E-04	1.89E-05
Transportation	1.26E-07	2.77E-08

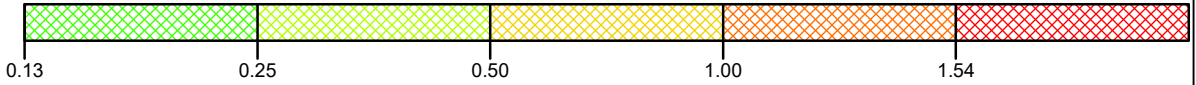
Output: -



PM₁₀: - 1.54 µg/m³

PM_{2.5}: - 0.10 µg/m³



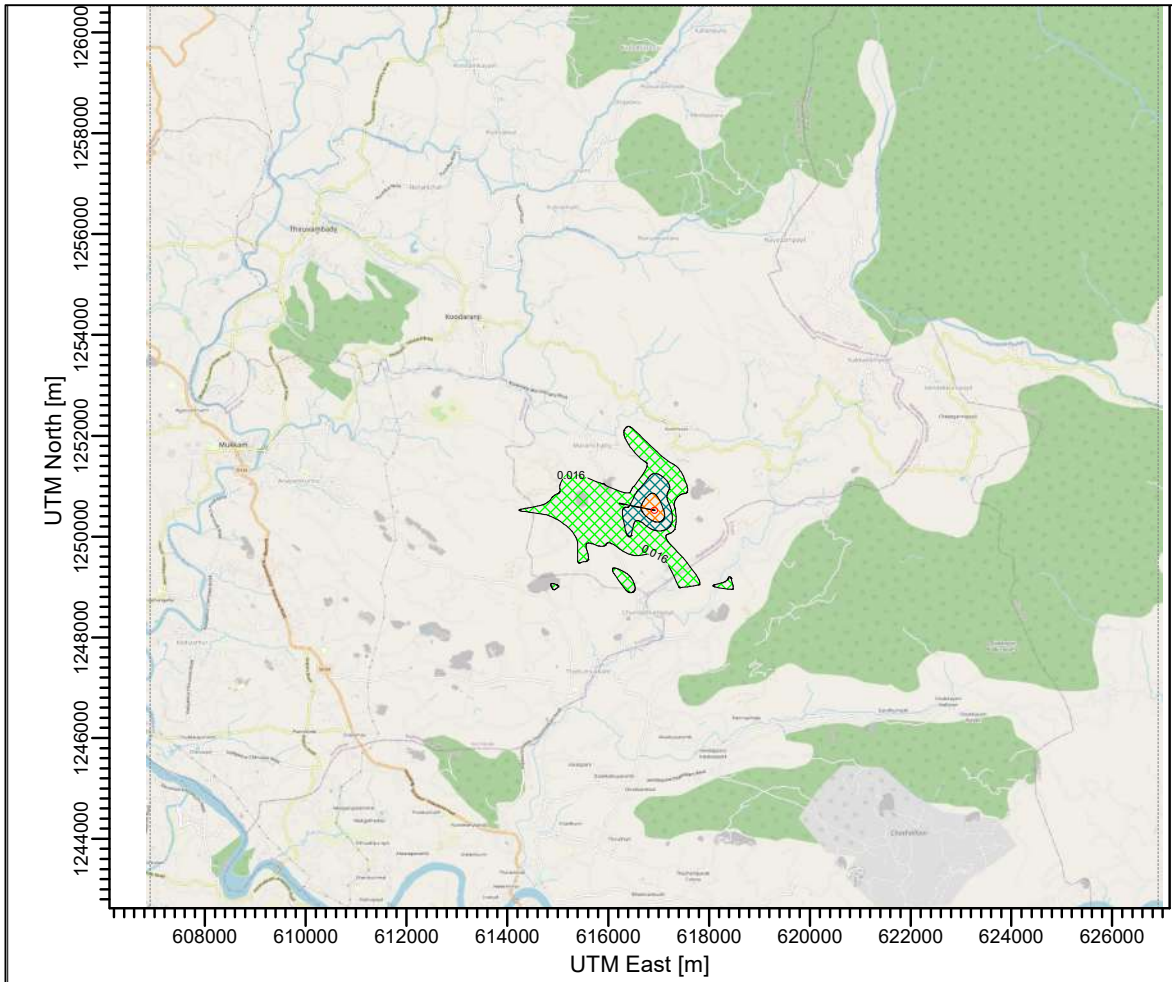
PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL ug/m³
 Max: 1.54 [ug/m³] at (616914.78, 1250518.27)



COMMENTS:	SOURCES: 2	COMPANY NAME: M/s Mukkom Property Developers Pvt. Ltd.	
	RECEPTORS: 0	MODELER: M/s Environmental Engineers & Consultants Pvt. Ltd.	
	OUTPUT TYPE: Concentration	SCALE: 1:146,540	
	MAX: 1.54 ug/m³		PROJECT NO.:

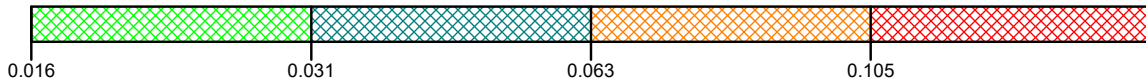
AERMOD View - Lakes Environmental Software

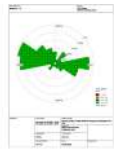

Isopleths Showing 24-hour GLC's of PM₁₀



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL
 Max: 0.105 [ug/m^3] at (616914.78, 1250518.27)

ug/m³



COMMENTS:	SOURCES: 2	COMPANY NAME: M/s Mukkom Property Developers Pvt. Ltd.	
	RECEPTORS: 0	MODELER: M/s Environmental Engineers & Consultants Pvt. Ltd.	
	OUTPUT TYPE: Concentration	SCALE: 1:132,034 0  5 km	
	MAX: 0.105 ug/m^3		PROJECT NO.:

AERMOD View - Lakes Environmental Software

Isopleths Showing 24-hour GLC's of PM_{2.5}

(RS. 200/- NON-JUDICIAL STAMP PAPER & TO BE NOTARIZED)

AFFIDAVIT

I, Abdul Azeez C.K., Managing Director of M/s Mukkom Property Developers Pvt. Ltd. having correspondence address at Cheenathamkuzhiyil, Malayamma Post, NIT, Kozhikode, Kerala-673601, do hereby affirm and confirm as follows:-

1. That, we propose to develop a building stone (Minor Mineral) quarry project at Survey No. (Un survey), Kumaranellor Village, Kozhikode Taluk, Kozhikode District, Kerala for a Mine Lease (ML) area of 8.1765 ha.
2. That, we will constitute an Environment Monitoring Cell for our project.
3. That, we will provide systems to minimize dust emissions.
4. That, we will provide adequate safety measures for the quarry workers during the mining operation.
5. That, we will upload the following in our web site.
 - a. EC Order
 - b. Status of compliance of the stipulated EC conditions.
 - c. Results of monitoring data and update the same periodically.
 - d. Send the copy of the EC to the LSG concerned

DEPONENT

Verification :

Verified that my above statements are true to the best of my knowledge and belief and nothing material has been concealed therein.

DEPONENT

Place : Kozhikode

Date :



National Accreditation Board for Education and Training



Certificate of Accreditation

Environmental Engineers & Consultants Pvt. Ltd, Delhi

A1-198, Janak Puri, New Delhi – 110058

The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including opencast / underground mining	1	1 (a) (i)	A
2	Building and construction projects	38	8 (a)	B
3	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated April 21, 2023 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/23/2752 dated May 01, 2023. The accreditation needs to be renewed before the expiry date by Environmental Engineers & Consultants Pvt. Ltd following due process of assessment.



Sr. Director, NABET
Dated: May 01, 2023

Certificate No.
NABET/EIA/2326/RA 0285

Valid up to
March 18, 2026



National Accreditation Board for
Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

**STANDARDS ENVIRONMENTAL & ANALYTICAL
LABORATORIES**

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

**"General Requirements for the Competence of Testing &
Calibration Laboratories"**

for its facilities at

K.J TOWER, PATHALAM, UDYOGAMANDAL P.O., ERNAKULAM, KERALA, INDIA

in the field of

TESTING

Certificate Number: TC-5402

Issue Date: 21/11/2021

Valid Until:

20/11/2023

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.

(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : STANDARDS ENVIRONMENTAL & ANALYTICAL LABORATORIES

Signed for and on behalf of NABL



N. Venkateswaran
Chief Executive Officer

IN THE HIGH COURT OF KERALA AT ERNAKULAM

Present:

THE HONOURABLE MR. JUSTICE A.MUHAMED MUSTAQUE

Monday, the 27th day of May 2019/6th Jyaishta, 1941

WP(C) No.13031/2019

PETITIONER

M/S. MUKKOM PROPERTY DEVELOPERS (P) LTD
CHEENATHAMKUZHIYIL, MALAYAMMA.P.O, CHATHAMANGALAM TALUK,
KOZHIKODE, REPRESENTED BY ITS MANAGING DIRECTOR.

RESPONDENTS

1. THE ADDITIONAL TAHSILDAR
KOZHIKODE, OFFICE OF THE ADDITIONAL TAHSILDAR,
TALUK OFFICE, KOZHIKODE-673020.
2. THE VILLAGE OFFICER,
KUMARANELLOOR VILLAGE, KUMARANELLOOR,
KOZHIKODE-673602.
3. THE DISTRICT GEOLOGIST,
DISTRICT OFFICE, CIVIL STATION, KOZHIKODE-673020.
4. THE DIRECTOR,
MINING AND GEOLOGY DAPARTMENT,
KESAVADASAPURAM, PATTOM PALACE.P.O, TRIVANDRUM-695004.

Writ Petition (civil) praying inter alia that in the circumstances stated in the affidavit filed along with the WP(C) the High Court be pleased to direct the respondents 3 and 4 to process Ext.P9 application without referring to the objection raised U/s.81(1) of the Act, 1963 and to issue Letter of Intent to the petitionoer forthwith, subject to the result of the Writ Petition.

This petition coming on for admission upon perusing the petition and the affidavit filed in support of WP(C) and upon hearing the arguments of M/S.PHILIP J.VETTICKATTU, G.HARIKRISHNAN, Advocates for the petitioner and of GOVERNMENT PLEADER for the respondents, the court passed the following:

ORDER

In the light of the judgment of this Court in Robin V., Taluk Land Board (2019(2)KLT 391), there shall be an interim order as prayed for.

Post on 21.06.2019.

27-05-2019

Sd/- A.MUHAMED MUSTAQUE, JUDGE

/true copy/


ASSISTANT REGISTRAR

EXHIBIT P9 - TRUE COPY APPLICATION SUBMITTED BY THE PETITIONER FOR
QUARRYING LEASE ALONG WITH RECEIPT.

Pb/27.05.19.

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27/5/19
27/5