DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

&

ENVIRONMENT MANAGEMENT PLAN

FOR OBTAINING

Environmental Clearance under EIA Notification – 2006 Schedule Sl. No. 1 (a) (i): Mining Project

"B1" CATEGORY – MINOR MINERAL – CLUSTER – NON-FOREST LAND

CLUSTER EXTENT = 9.23.5 ha

THIRU. C. RENGARAJ ROUGH STONE QUARRY

NOVEMBER 2022

Project Proponent	Proposed Project	Extent
Thiru. C. Rengaraj, S/o. Chinnaiya, No. 1/133, Melamuthukadu, Cauvery Nagar Post, Kulathur Taluk, Pudukkottai District – 625 501.	S.F. Nos:217/3A, 217/20, 217/21, 217/22 & 217/24 Sathiyamangalam Village Kulathur Taluk Pudukkottai District Tamil Nādu State	**1.34.0ha**

ToR obtained vide
Letter No.SEIAA- TN/F.No.8551/SEAC/ToR-1141/2022 Dated:08.04.2022

Environmental Consultant	Laboratory
GEO EXPLORATION AND MINING SOLUTIONS Old No. 260-B, New No. 17, Advaitha Ashram Road, Alagapuram, Salem – 636 004, Tamil Nadu, India **Accredited for sector 1 Cat 'A'& 38 Cat 'B'** **Certificate No : NABET/EIA/1922/SA 0139** Phone: 0427-2431989, Email: ifthiahmed@gmail.com, geothangam@gmail.com **Web:** www.gemssalem.com	**CHENNAI METTEX LAB PRIVATE LIMITED,** Jothi Complex, 83, M.K.N. Road, Guindy, Chennai 600 032. AAI, AGMARK, APEDA, BIS, [IC, FSSAI, GAFTA, IOPEPC, MOEF & TEA BOARD

For easy represantation of Proposed and Existing Quarries in the Cluster are given unique codes and identifies and studied in this EIA/EMP Report.

PROPOSED QUARRIES				
CODE	Name of the Owner	S.F. Nos	Extent	Status
P1	Thiru. C. Rengaraj, S/o. Chinnaiya, No. 1/133, Melamuthukadu, Cauvery Nagar Post, Kulathur Taluk, Pudukkottai District – 625 501.	S.F.Nos:217/3A, 217/20, 217/21, 217/22 & 217/24	1.34.0ha	ToR Obtained vide Lr.No. SEIAA-TN/F.No.8551/SEAC/ToR-1141/2022 Dated:08.04.2022
P2	Thiru. Bahurudeen, S/O. Sahul Hameed, No. 215, Kallar Street, Thiruvapoor, Pudukkottai	220/24B2, etc.,	1.14.0 ha	EC Granted vide Lr.No.SEIAA-TN/F.No.7731/EC.No:5002/2020 dated 18.02.2022
P3	M/s. Veeram Stones Pvt., Ltd., 952, Udaiyandipatti Village, Sathiyamangalam Post, Kulathu Taluk, Pudukkottai District.	214/5, 214/8, 214/9 and 214/2A	0.73.0	Under process of Geology Department
P4	Thiru. S. Manikandan, S/o. S.M.Sait, 51,52 Charlas Nagar, 2nd Street, Pudukkottai	220/29 & 219	0.93.5	Awaiting EC
	TOTAL		4.14.5ha	
EXISTING QUARRIES				
CODE	Name of the Owner	S.F. Nos	Extent	Status
E1	Thiru. B. Kajamaideen, S/o. Bahurudeen, No. 215, Kallar Street, Thiruvappur, Pudukkottai	217/1B, etc.,	1.90.0	07.09.2018 to 06.09.2023
	TOTAL		1.90.0ha	
EXPIRED QUARRIES				
CODE	Name of the Owner	S.F. No	Extent	Lease Period
EX1	Thiru. L. Thangadurai, S/o. Lakshman, Udaiyandipatti, Sathiyamangalam (Po) Kulathur Taluk,	217/6, 7A	0.88.0	03.07.2007 to 02.07.2012
EX2	Thiru. P. Murugesan, S/o. Palani, Sithannavasal, Illuppur Taluk.	217/2a, etc.,	2.31.0	03.06.2010 to 02.06.2015
			3.19.0 ha	
	TOTAL CLUSTER EXTENT		9.23.5 ha	

Note:-
* **Cluster area is calculated as per MoEF & CC Notification – S.O. 2269 (E) Dated: 01.07.2016**

TERMS OF REFERENCE (ToR) COMPLIANCE

Thiru. C. Rengaraj

"ToR Obtained vide Lr.No Letter No.SEIAA- TN/F.No.8551/SEAC/ToR-1141/2022 Dated:08.04.2022"

SPECIFIC CONDITIONS		
1	The Proponent shall carry out the cumulative & comprehensive impact study due to mining operations carried out in the quarry cluster specifically with reference to the environment in terms of air pollution, water pollution, & hearth impacts, accordingly the Environment Management plan should be prepared keeping the concerned quarry and the surrounding habitations in the mind	Noted and agreed
2	The certified existing EC compliance report shall be included in the EIA Report	Noted and agreed
3	A letter indicating exact distance between the least boundary of the project site and Narthamalai RF from DFO/Revenue department	DFO Will be submitted during Final EIA Report
4	A temple is located nearer to the project site, the PP shall include the details of how often the festivals conducted in a year and how many people are gathered during the festivals obtained from competent authority	Noted and agreed
5	The entire cluster of mine lease area shall be video graphed through Drone and submit the same along with EIA report	Noted and agreed
6	If the proponent has already carried out the mining activity in the proposed mining lease area after 15.01.2016, then the proponent shall furnish the following details from AD/DD, mines a) what was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines? b) Quantity of minerals mined out c) Highest production achieved in any one year d) Detail of approved depth of mining e) Actual depth of the mining achieved earlier f) Name of the person already mined in that leases area g) If EC and CTO already obtained' the copy of the same shall be submitted h) whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches	Previous lease period 28.05.2014 to 27.05.2019 operated by Thiru. C. Rengaraj, EC obtained vide Lr.No.SEIAA-TN/F.No.1296/EC/1(a)/1094/2013 dated: 27.02.2014. CTO Obtained vide F. PDK0704/RS/DE/TNPCB/PDK/W/W2014 dated 26.03.2014.
7	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/Topo sheet, topographic sheet, geomorphology, lithology and geology of the mining lease 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)	Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3, EIA Report Surface Features around the project area covering 10km radius – Figure No. 2.4, EIA Report Geology map of the project area covering 10km radius - Figure No. 2.7, EIA Report Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8, EIA Report
8	The proponent shall furnish photographs of adequate fencing, green belt along the periphery Including replantation of existing trees & safety distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan	Noted and agreed It is proposed to be planted a total of 750 nos. of trees for 5 years period for greenbelt development and avenue plants are proposed to be developed around the mines office.
9	The Project Proponent shall provide the details of mineral reserves and mineable reserves, planned	Noted and agreed Discussed in Chapter-2

	production capacity, proposed working methodology with justifications, the anticipated impacts of the mining operations on the surrounding environment and the remedial measures for the same	
10	The Project Proponent shall provide the organization chart indicating the appointment of various statutory officials and other competent persons to be appointed as per the provisions of Mines Act'1952 and the MMR, 1961 for carrying out the quarrying operations scientifically and systematically in order to ensure safety and to protect the environment.	Noted and agreed
11	The project proponent shall conduct the hydro-geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within 1km (radius) along with the collected water level data for both monsoon and non-monsoon seasons from the PWD/TWAD so as to assess the impacts on the wells due to mining activity. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation is this regard may be provided.	The details will be discussed in the Final EIA report.
12	The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quality, air quality, soil quality & Flora/fauna including traffic/vehicular movement study	Noted and agreed Discussed in Chapter-3
13	A tree survey study shall be carried out (nos., name of the species, age, diameter etc.,) both within the mining lease applied area & 300m buffer zone and its management during mining activity	Noted and agreed There are no trees within the lease applied area and no cutting down of trees are anticipated as it's an existing quarry. The proposed trees is 750 nos
14	A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific	The existing green belts are shown in Chapter no.2 The applied area is devoid of major vegetation. The proposal for green belt development is discussed in Chapter No.4.
15	The Public hearing advertisement shall be published in one major National daily and one most circulated vernacular daily	Noted and agreed
16	The recommendation for the issue of "Terms or Reference, is subjected to the outcome of the Hon'ble NGT, principal Bench, New Delhi in O. A No.186 of 2016 (M.A.No.350/2016) and O.A. No.200/2016 and O.A.No.580/2016 (M.A.No. 1182/2016) and O.A.No.l02/2017 and O.A.No.404/2016 (M.A.No. 758/2016, M.A.No.920/2016, M.A.No.1122/2016. M.A.No.12/2017 & M.A. No.843/2017) and O.A.No.405/2016 and O.A.No.520 of 2016 (M.A.No. 981/2016, M.A.No.982/2016 & M.A.No.384/2017).	Noted and agreed
17	The purpose of green belt around the project is to capture the fugitive emissions. carbon sequestration and to attenuate the noise generated, in addition to improving the aesthetics. A wide range of indigenous plant species should be planted as given in the appendix in consultation with the DFO, State Agriculture University. The plant species with dense/moderate canopy of native origin should	Noted and agreed
18	Taller/one year old Saplings raised in appropriate	Noted and agreed

	size of bags, preferably eco-friendly bags should be planted in proper espacement as per the advice of local forest authorities / botanist / Horticulturist with regard to site specific choices. The proponent shall earmark the greenbelt area with GPS coordinates all along the boundary of the project site with at least 3 meters wide and in between blocks in an organized manner.	
19	A Disaster management Plan shall be prepared and included in the EIA/EMP Report	Noted and agreed Discussed in Chapter: 7
20	A Risk Assessment and management Plan shall be prepared and included in the EIA/EMP Report	Noted and agreed Discussed in Chapter: 7
21	The Socio-economic studies should be carried out within a 5 km buffer zone from the mining activity. 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	Noted and agreed Discussed in Chapter: 3
22	If any quarrying operations were carried out in the proposed quarrying site for which now the EC is sought, the Project Proponent shall furnish the detailed compliance to EC conditions given in the previous EC with the site photographs which shall duly be certified by MoEF&CC, Regional Office, Chennai (or) the concerned DEE/TNPCB.	Noted and agreed
23	Concealing any factual information or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this Terms of Reference besides attracting penal provisions in the Environment (Protection) Act, 1986.	Noted and agreed
ADDITIONAL CONDITIONS		
1	As per the MoEF& CC office memorandum F.No.22-6512017-IA.III dated: 30.09.2020 and 20.10.2020 the proponent shall address the concerns raised during the public consultation and all the activities proposed shall be part of the Environment Management Plan	Agreed and noted.
2	The Environmental Impact Assessment shall study in detail the carbon emission and also suggest the measures to mitigate carbon emission including development of carbon sinks and temperature reduction including control of other emission and climate mitigation activities.	Noted and agreed A greenhouse gas, Carbon dioxide (CO_2), Methane (CH4), Therefore, the implementation of proposed mitigation measures for winning of mineral may not have much of impact on the surrounding environment leading to release of Greenhouse gases (GHC), rise in temperature & livelihood of local people. Apart from which, its proposed for deployment of New Modern Machineries (BSVI) and PUC certified Vehicles.
3	The Environmental Impact Assessment should study the biodiversity, the natural ecosystem, the soil micro flora, fauna and soil seed banks and suggest measures to maintain the natural Ecosystem.	Noted and agreed Discussed in Chapter: 3
4	Action should be specifically suggested for sustainable restoration of ecosystem for flow of goods and services.	Noted and agreed During Mine Closure the excavated pit will be allowed to collect rain water and shall act as an artificial reservoir and shall prove beneficial for the ecosystem. The proposed greenbelt activity shall also prove beneficial for the ecosystem during mine closure

5	The project proponent shall study impact on fish habitats and food WEB/food chain in the water body and Reservoir	Noted and agreed
6	The Terms of Reference should specifically study impact on soil health, soil erosion. the soil physical, chemical components and microbial components	Noted and agreed The top layer in the form of Gravel formation, the Gravel will be directly loaded into tippers and sold to needy customers.
7	The Environmental Impact Assessment should study impact on forest, vegetation, endemic, vulnerable and endangered indigenous flora and fauna	Noted and agreed
8	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection.	Noted and agreed The applied area is barren patta land with no major vegetation or trees within the project areas. It is an existing quarry, there is no trees within the applied project area and devoid of major vegetation.
9	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites	Noted and agreed Discussed in Chapter: 3
10	The Environmental Impact Assessment should hold detailed study on EMP with budget for green belt development and mine closure plan including disaster management plan	Noted and agreed Disaster Management plan & mine closure plan is discussed in chapter no.4 & 7.
11	The Environmental Impact Assessment should study impact on climate change, temperature rise, pollution and above soil & below soil carbon stock	Noted and agreed Discussed in Chapter: 3
12	The Environmental Impact Assessment should study impact on protected areas, Reserve Forests, National Parks, Corridors and Wildlife pathways, near project site.	Noted and agreed Reserve forest :1.02 km North , Narthamali R.F
13	The project proponent shall study and furnish the impact of project on plantations in adjoining patta lands, Horticulture, Agriculture and livestock	Noted and agreed No major agriculture activities in the vicinity of the area, agriculture is practiced only during rainy seasons.
14	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment, by the activities	Noted and agreed
15	The project proponent shall study and furnish the impact on aquatic plants and animals in water bodies and possible scars on the landscape, damages to nearby caves, heritage site, and archaeological sites possible land form changes visual and aesthetic impacts	Noted and agreed No proposal for the discharge of mine pit water in to the nearby water bodies .The project will not have any impact to the aquatic plant's animals in the water bodies. It's a hard batholithic formation no previous records related to landslides and earth quake in this area. No archaeological sites in the vicinity of the project area.
16	The project proponent shall study and furnish the possible pollution due to plastic and microplastic on the environment. The ecological risks and impacts of plastic & microplastics on aquatic environment and fresh water systems due to activities, contemplated during mining may be investigated and reported	Noted and agreed Discussed in Chapter: 7
17	The project proponent shall detail study on impact of mining on Reserve forests free ranging wildlife	Noted and agreed This Rough stone and Gravel quarry project involves conventional method of drilling and blasting will not have significant impact to the forest area and wild life

18	The project proponent shall study on impact of different pathways and migration.	Noted and agreed
STANDARD TERMS OF REFERENCE		
1	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. 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 1994.	Not applicable. This is Not a violation category project. This proposal falls under B1 Category (Cluster Condition).
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 applied land for quarrying is a Patta Land. Document is enclosed along with Approved Mining Plan as Annexure Volume 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.	Noted & agreed.
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).	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.1 Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3 Surface Features around the project area covering 10km radius – Figure No. 2.2 Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.
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.	Map showing – Geology map of the project area covering 10km radius - Figure No. 2.7. Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.8.
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.	The applied area was inspected by the officers of Department of Geology along with revenue officials and found that the land is fit for quarrying under the policy of State Government.
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 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	The proponent has framed their Environmental Policy and the same is discussed in the Chapter No 10.1.

	stakeholders at large, may also be detailed in the EIA Report.	
8	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	It is an opencast quarrying operation proposed to operate in Mechanized method. The rough stone formation is a hard, compact and homogeneous body. The height and width of the bench will be maintained as 5m with 90^0 bench angles. Quarrying activities will be carried out under the supervision of Competent Persons like Mines Manager, Mines Foreman and Mining Mate. Necessary permissions will be obtained from DGMS after obtaining Environmental Clearance.
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.	Noted & agreed. The study area considered for this study is 10 km radius and all data contained in the EIA report such as waste generation etc., is 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.	Land use and land cover of the study area is discussed in Chapter No. 3. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3.
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	Not Applicable. There is no waste anticipated during this quarry operation. The entire quarried out rough stone will be transported to the needy customers. No Dumps is proposed outside the lease area.
12	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 Committees.	Not Applicable. There is no Forest Land involved in the proposed project area. The proposed project area is a patta land. Approved Mining Plan is enclosed as Annexure Volume 1.
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.	Not Applicable. The proposed project area does not involve any Forest Land.
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.	Not Applicable. The project doesn't attract Recognition of Forest Rights Act, 2006.
15	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	No Reserve Forest within the Study Area.
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	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.

	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 clearly 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	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
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.	Detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] was carried out and discussed under Chapter No. 3. There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area.
19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravalli 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 Department should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.
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).	Not Applicable. The project doesn't attract The C. R. Z. Notification, 2018.
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 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	Not Applicable. There are no approved habitations within a radius of 300 meters. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.

	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 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	Baseline Data were collected for One Season (Summer) March– May 2022 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.
23	Air quality modelling 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 modelling 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 direction may also be indicated on the map.	Air Quality Modelling for prediction of incremental GLC's of pollutant was carried out using AERMOD view 9.6.1 Model. Details in Chapter No. 4.
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.	Total Water Requirement: 5.0 KLD Discussed under Chapter 2, Table No 2.15 .
25	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Not Applicable. Water for dust suppression, greenbelt development and domestic use will be sourced from accumulated rainwater/seepage water in mine pits and purchased from local water vendors through water tankers on daily requirement basis. Drinking water will be sourced from the approved water vendors.
26	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	Part of the working pit will be allowed to collect rain water during the spell of rain will be used for greenbelt development and dust suppression. The Mine Closure Plan is prepared for converting the excavated pit into rain water harvesting structure and serve as water reservoir for the project village during draught season.
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.	Impact Studies and Mitigation Measures of Water Environment including Surface Water and Ground Water are discussed in 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	Not Applicable. The ground water table inferred 65-70m below ground level. The ultimate depth of quarry is 30m agl.

	working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, 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.	This proposal of 30 m below ground level will not intersect the ground water table, which is inferred from the hydro-geological carried out at the project site. Discussed under 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.	Not Applicable. There is no stream, seasonal or other water bodies passing within the project area. Therefore, no modification/ diversion of water bodies is anticipated.
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.	Highest elevation of the project area is 408m AMSL. Ultimate depth of the mine is 30m BGL Water level of the area is 65-70m BGL
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 compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. 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.	Greenbelt Development Plan is discussed under Chapter 4, Page No.123.
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.	Traffic density survey was carried out to analyse the impact of Transportation in the study area as per IRC guidelines 1961 and it is inferred that there is no significant impact due to the proposed transportation from the project area. Details in Chapter 2, Page No.30-32.
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Infrastructure & other facilities will be provided to the Mine Workers after the grant of quarry lease and the same has been discussed in the Chapter No.2 Page No.32.
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.	Discussed under Chapter 2. Mine Closure Plan is a part of Approved Mining Plan enclosed as Annexure Volume – 1.
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	Occupational Health Impacts of the project and preventive measures are detailed under Chapter 4, Page No.127.

	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.	No Public Health Implications anticipated due to this project. Details of CER and CSR are discussed under Chapter 8, Page No. 148-149.
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.	No Negative Impact on Socio Economic Environment on the Study Area is anticipated and this project shall benefit the Socio-Economic Environment by ways of employment for 56 people directly and 30 people indirectly. Details in Chapter 2, Page No. 33.
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 agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Detailed Environment Management Plan for the project to mitigate the anticipated impacts described under Chapter 4 is discussed under Chapter 10, Page No. 151 – 156.
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.	The outcome of public hearing will be updated in the final EIA/AMP report
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.	No litigation is pending in any court against this project.
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.	Project Cost is Rs.26,93,000/- CER Cost is Rs 5,00,000/-
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Details in 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.	Details in Chapter 8.
44	Besides the above, the below mentioned general points are also to be followed: -	
a	Executive Summary of the EIA/EMP Report	Enclosed as separate booklet.
b	All documents to be properly referenced with index and continuous page numbering.	All the documents are 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.	List of Tables and source of the data collected are 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	Baseline monitoring reports are enclosed with This report in Chapter 3. Original Baseline monitoring reports will be submitted in the final EIA report during appraisal.
e	Where the documents provided are in a language other than English, an English translation should be provided.	Not Applicable.
f	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	Will be enclosed along with Final EIA EMP Report.
g	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF&CC vide O.M.	Noted & agreed. Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IA. II (I) Dated: 4th August, 2009 are

	No. J-11013/41/2006-IA. II(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	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	Noted & agreed.
i	As per the circular no. J-11011/618/2010-IA. II(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not Applicable.
j	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Surface Plan – Figure No. 2.2. Geological Plan – Figure No 2.9. Working Plan – Figure No 2.9. Closure Plan – Figure No.2.10.

TABLE OF CONTENTS

b

LIST OF TABLES

LIST OF FIGURES

1.   INTRODUCTION

1.0   PREAMBLE

Environmental Impact Assessment (EIA) is the management tool to ensure the sustainable development and it is a process, used to identify the environmental, social and economic impacts of a project prior to decision-making. It is a decision-making tool, which guides the decision makers in taking appropriate decisions for any project. EIA systematically examines both beneficial and adverse consequences of the project and ensures that these impacts are taken into account during the project designing. It also reduces conflicts by promoting community participation, information, decision makers, and helps in developing the base for environmentally sound project.

Rough Stone is the major requirements for construction industry. This EIA report is prepared by considering Cumulative load of proposed & existing quarries of Thiru. C. Rengaraj Rough Stone Quarry consisting of one Proposed, Three Nearby Proposed Quarries and One Existing Quarry with total extent of Cluster of 9.23.5 ha in Sathiyamangalam Village, Kulathur Taluk, Pudukkottai District and Tamil Nadu State, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

Baseline Monitoring study has been carried out during the period of March to May 2022 and this EIA and EMP report is prepared for considering cumulative impacts arising out of this project, the Cumulative Environmental Impact Assessment study is undertaken, which is followed by preparation of a detailed Environmental Management Plan (EMP) individually to minimize those adverse impacts.

1.1   PURPOSE OF THE REPORT

The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14th September 2006 and its subsequent amendments   as per Gazette Notification S.O. 3977 (E) of 14th August 2018, Mining Projects are classified under two categories i.e. A (> 100 Ha) and B (≤ 100 Ha), and Schematic Presentation of Requirements on Environmental Clearance of Minor Minerals including cluster situation in Appendix–XI.

Now, as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018 clarified the requirement for EIA, EMP and therefore, Public Consultation for all areas from 5 to 25 ha falling in Category B- 1 and appraised by SEAC/ SEIAA as well as for cluster situation.

The proposed project is categorized under category "B1" Activity 1(a) (mining lease area in cluster situation) and will be considered at SEIAA – TN after conducting Public Hearing and Submission of EIA/EMP Report for Grant of Environmental Clearance.

"Draft EIA report prepared on the basis of ToR Issued ToR for carrying out public hearing for the grant of Environmental Clearance from SEIAA, Tamil Nadu"

FIGURE.1.1 SATELLITE IMAGERY CLUSTER QUARRIES
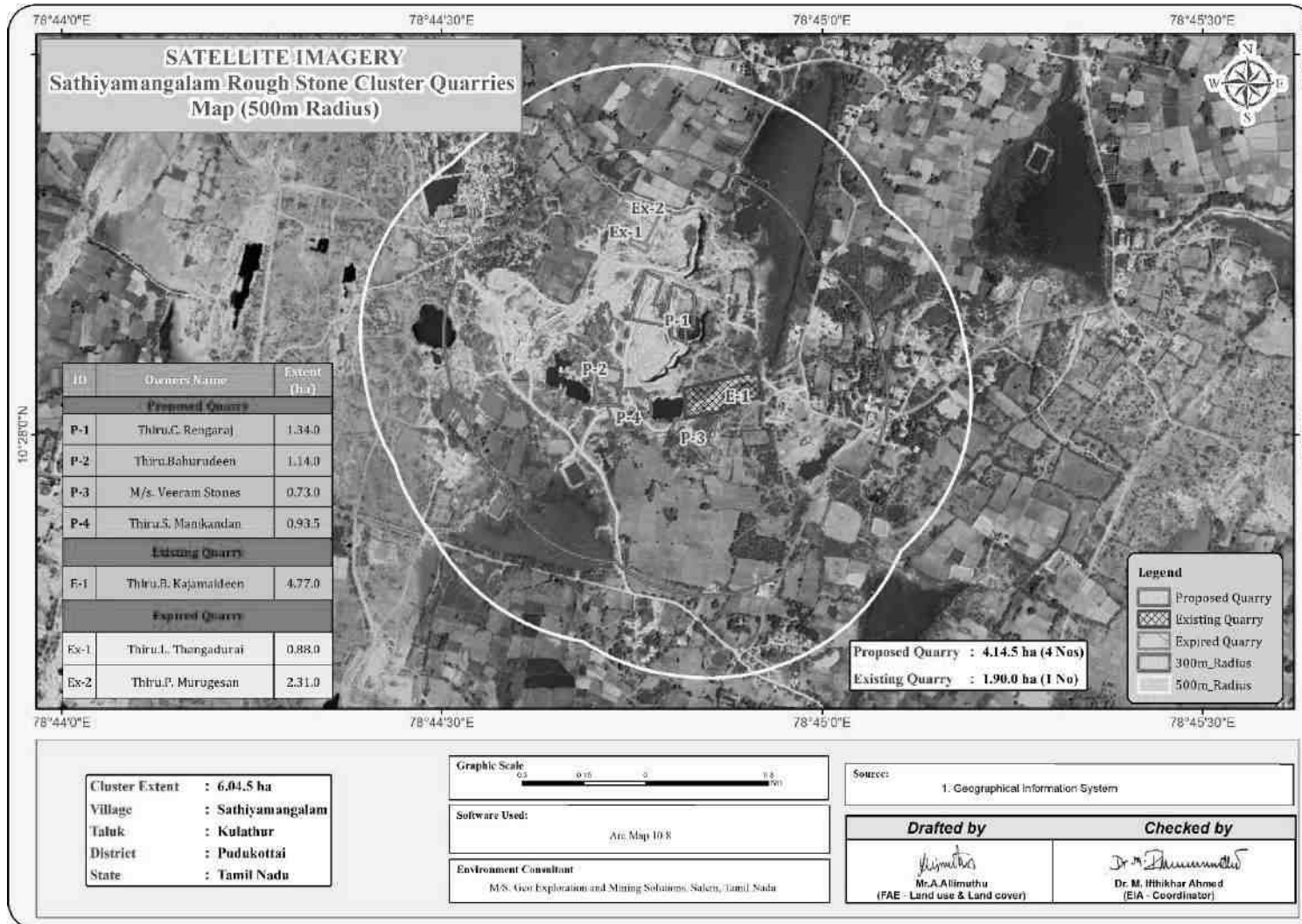
1.2   IDENTIFICATION OF PROJECT AND PROJECT PROPONENT
1.2.1   Identification of Project

TABLE 1.1: SALIENT FEATURES OF THE PROPOSED PROJECT

Name of the Project	Thiru. C. Rengaraj Rough Stone Quarry Project
S.F. No.	217/3A, 217/20, 217/21, 217/22 & 217/24
Extent	1.34.0 ha
Land Type	Patta Land
Village Taluk and District	Sathiyamangalam Village, Kulathur Taluk, Pudukkottai District

Source: Approved Mining Plan.

1.2.2   Identification of Project Proponent

TABLE 1.2: DETAILS OF PROJECT PROPONENT

Name of the Company	Thiru. C. Rengaraj Rough Stone Quarry Project
Address	S/o. Chinnaiya, No. 1/133, Melamuthukadu, Cauvery Nagar Post, Kulathur Taluk, Pudukkottai District – 625 501.
Mobile	94431 39189
Status	Individual

Source: Approved Mining Plan.

1.3   BRIEF DESCRIPTION OF THE PROJECT
1.3.1   Nature and Size of the Project

Common Mining Methodology is proposed for one proposed mine.

The quarrying operation is to be carried out by Opencast Mechanized Mining method with 5.0m bench height and 5.0m bench width by deploying Jack Hammer Drilling & Slurry Explosive during blasting. Hydraulic Excavator and tippers are used for Loading and transportation. Rock Breakers are deployed to avoid secondary blasting.

TABLE 1.3: BRIEF DESCRIPTION OF THE PROJECT

Name of the Quarry	Thiru. C. Rengaraj Rough Stone Quarry		
Toposheet No	58-J/11		
Latitude between	10°28'07.82"N to 10°28'12.86"N		
Longitude between	78°44'45.46"E to 78°44'50.48"E		
Highest Elevation	112 m AMSL		
Proposed Depth of Mining	30m bgl		
Geological Resources	Rough Stone in m³	Weathered rock m³	Topsoil m³
	3,57,660	21,044	31,380
Mineable Reserves	Rough Stone in m³	Weathered rock m³	Topsoil m³
	42,620	8,648	17,781
Year wise Production for 5 years	Rough Stone in m³	Weathered rock m³	Topsoil m³
	42,620	8,648	17,781
Existing Pit Dimension	60m (L) x 55m (W) x 17m (D) bgl		
Ultimate Pit Dimension	137m (L) x 98m (W) x 30m (D) bgl		
Water Level in the surrounds area	65 – 70m bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is exhibits plain topography. The area has gentle sloping towards eastern side. The altitude of the area is 112m (max) above mean sea level. The area is covered by 3m thickness of topsoil and 2m weathered rock. Massive charnockite is found after 3m topsoil and 2m weathered rock which is clearly inferred from the existing quarrying pits.		
Machinery proposed	Jack Hammer		2 Nos
	Compressor		1 No
	Excavator with bucket and rock breaker		1 No

	Trucks	1 No
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	14 Nos	
Project Cost	Rs.26,93,000/-	
CER Cost @ 2% of Project Cost	Rs 5,00,000/-	
Nearby Water Bodies	Odai	10m Safety East
	Tank	120m NE
	Tank	400m SW
	Kuttai	370m SW
	Lake near Vellanur	4.8km East
	Lake Near Sembattur	8.4km NE
Greenbelt Development Plan	Proposed to plant 750 trees in 1300Sq.m area in the 7.5m & 10m Safety Zone and panchayat roads	
Proposed Water Requirement	2.0 KLD	
Nearest Habitation	350m Southeast	

Source: Approved Mining Plan

1.3.2 Location of the Project

- The proposed quarry project falls in Sathiyamangalam Village, Kulathur Taluk and Pudukkottai District.
- Thiru. C. Rengaraj Rough stone quarry cluster is located about 3.0 km Southwest side of Sathiyamangalam Village
- The Sathiyamangalam Village is located about 9 km South West of Kulathur Taluk.
- The area is marked in the Survey of India, Toposheet No. 58-J/11. The area lies between the Latitudes of 10°28'07.82"N to 10°28'12.86"N and Longitudes of 78°44'45.46"E to 78°44'50.48"E

FIG1.2 KEY MAP SHOWING THE LOCATION OF THE CLUSTER SITE

KEY MAP

INDIA

TAMILNADU STATE

Pudukottai-DISTRICT

Kulathur-TALUK

Sathiyamangalam-Village
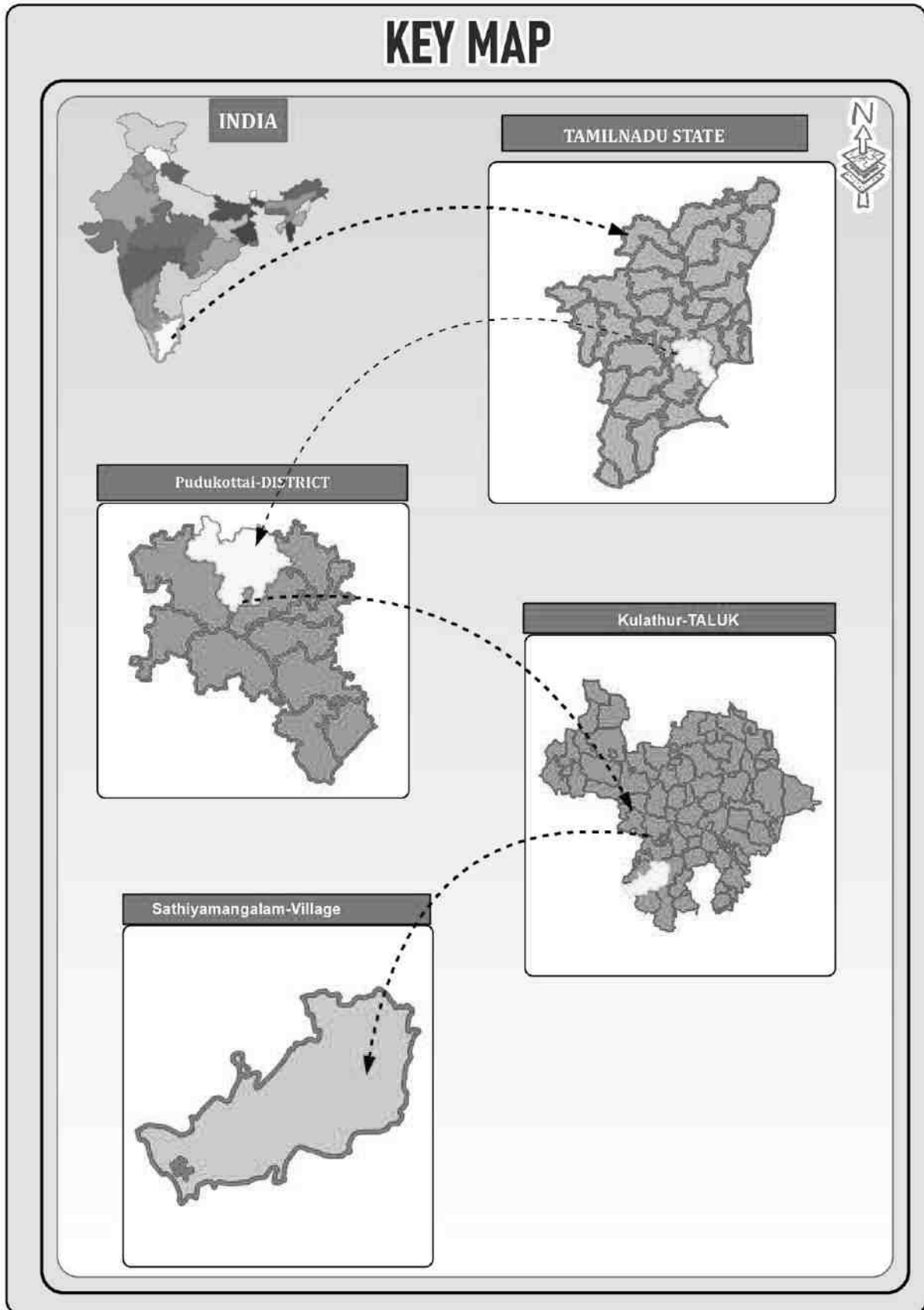
Source: Survey of India Toposheet 58-A/16

FIG1.2 KEY MAP SHOWING THE LOCATION OF THE CLUSTER SITE

FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS
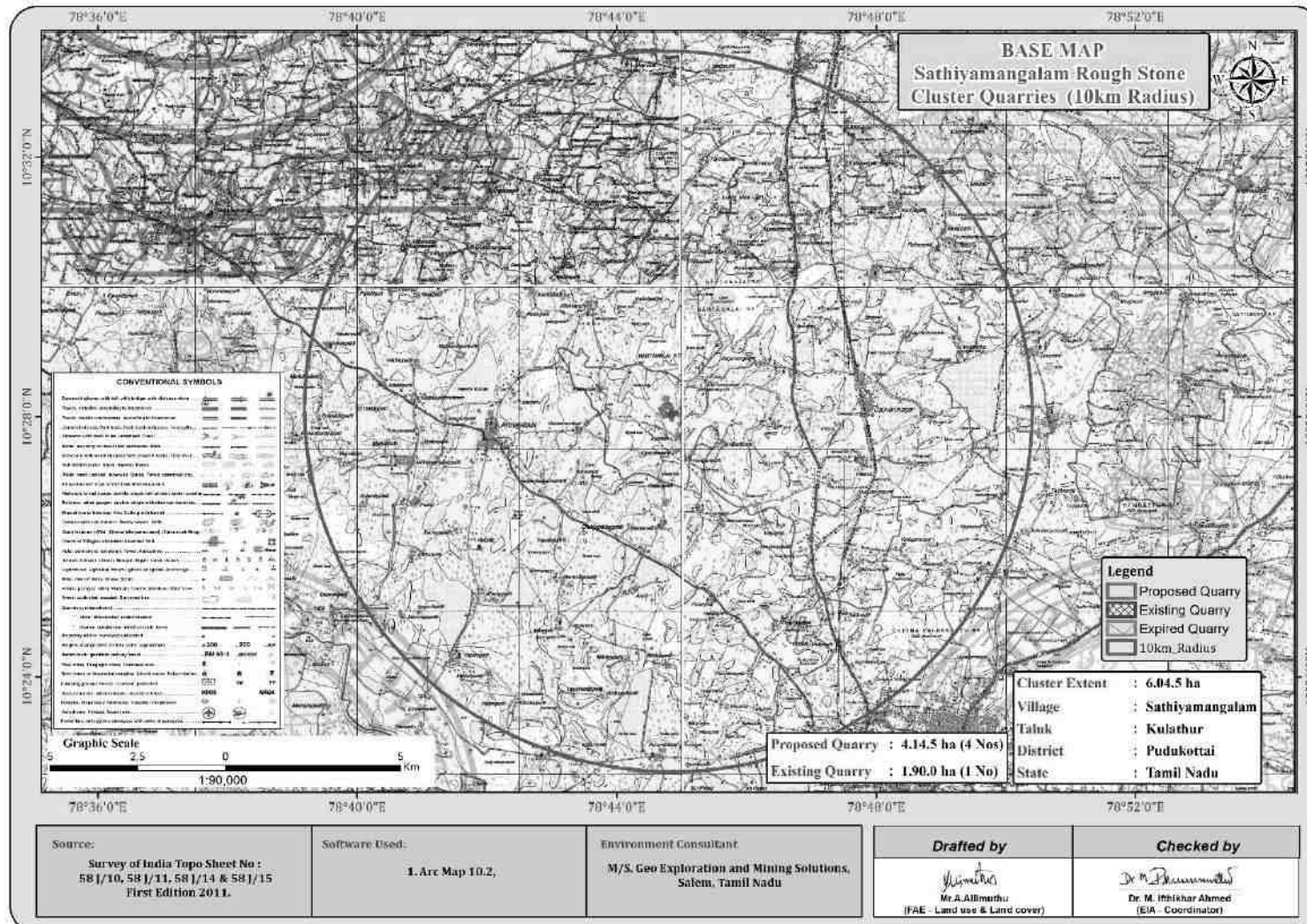
Source: Survey of India Toposheet 58-J/11

1.4   ENVIRONMENTAL CLEARANCE

The Environmental Clearance process for the project will comprise of four stages. These stages in sequential order are given below:-

1. Screening,
2. Scoping
3. Public consultation &
4. Appraisal

SCREENING

- The proponent applied for Rough Stone Quarry Lease Dated: 20.07.2020.

- Precise Area Communication Letter was issued by the District Collector, Pudukkottai, vide letter No. 177/2020 (G&M) dated 04.02.2021.

- The Mining Plan was prepared by Qualified Person and approved by Deputy Director, Geology and Mining, Pudukkottai District, vide Rc.No.177/2020 (G&M) dated 17.03.2021.

- The proposed project falls under "B1" Category as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018

- Proponent applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/62979/2021, Dated: 29.04.2021.

SCOPING

- The proposal was placed in 253rd SEAC meeting held on 11/03/2022 and the committee recommended for issue of ToR.

- The proposal was considered in 497th SEIAA meeting held on 07.04.2022 and issued ToR vide Lr No. SEIAA-TN/F.No. 8551/SEAC/ToR-1141/2022 Dated: 08.04.2022.

PUBLIC CONSULTATION –

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the district is submitted along with this Draft EIA/ EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

APPRAISAL –

Appraisal is the detailed scrutiny by the State Expert Appraisal Committee (SEAC) of the application and other documents like the final EIA & EMP Report, outcome of the Public Consultations including Public Hearing Proceedings, submitted by the proponent to the regulatory authority concerned for grant of environmental clearance. The report has been prepared using the following references:

- Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, 2010
- EIA Notification, 14thSeptember, 2006
  - Lr No. SEIAA-TN/F.No.8551/SEAC/ToR -1141/2022 Dated: 08.04.2022.
  - Approved Mining Plan.

1.5   TERMS OF REFERENCE (ToR)

ToR issued vide –

- ToR Lr No. SEIAA-TN/F.No.8551/SEAC/ToR-1141/2022 Dated: 08.04.2022. Area detailed in Page No. I – XLIX.

1.6   POST ENVIRONMENT CLEARANCE MONITORING

The respective proposed project proponents shall submit a half-yearly compliance report in respect of stipulated Environmental Clearance terms and conditions to MoEF & CC Regional Office & SEIAA after grant of EC on 1ˢᵗ June and 1ˢᵗ December of each calendar year as per MoEF & CC Notification S.O. 5845 (E) Dated: 26.11.2018.

1.7   GENERIC STRUCTURE OF EIA DOCUMENT

The overall contents of the EIA report follow the list of contents prescribed in the EIA Notification 2006 and the "Environmental Impact Assessment Guidance Manual for Mining of Minerals" published by MoEF & CC.

1.8   THE SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the summer season (March – May 2022) for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suggest suitable mitigation measures for likely adverse impacts due to the proposed project.

TABLE 1.4: ENVIRONMENT ATTRIBUTES

Sl.No.	Attributes	Parameters	Source and Frequency
1	Ambient Air Quality	PM10, PM 2.5, SO2, NO2	Continuous 24-hourly samples twice a week for three months at 8 locations (1 Core & 7 Buffer)
2	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	Near project site continuous for three months with hourly recording and from secondary sources of IMD station
3	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 6 locations – 5 ground water and 1 surface water samples; once during study period.
4	Ecology	Existing terrestrial and aquatic flora and fauna within 10 km radius circle.	Limited primary survey and secondary data was collected from the Forest department.
5	Noise levels	Noise levels in dB(A)	8 locations – data monitored once for 24 hours during EIA study
6	Soil Characteristics	Physical and Chemical Parameters	Once at 6 locations during study period
7	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk analysis done for the risk associated with mining.

Source: Field Monitoring Data

The data has been collected as per the requirement of the ToR issued by SEIAA – TN.

1.8.1 Regulatory Compliance & Applicable Laws/Regulations

- ➢ Application for Quarrying Lease as per Tamil Nadu Minor Mineral Concession Rules, 1959

- ➢ Obtained Precise Area Communication Letter as per Tamil Nadu Minor Mineral Concession Rules, 1959 for Preparation of Mining Plan and obtaining Environmental Clearance

- ▪ The Mining Plan has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959
- ▪ ToR Lr No. SEIAA-TN/F.No.8551/SEAC/ToR-1141/2022 Dated: 08.04.2022.

2.   PROJECT DESCRIPTION

2.0   GENERAL

The Proposed Rough Stone Quarries requires Environmental Clearance. There are one proposed and one existing quarry forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is **9.23.5 ha.**

As the extent of cluster are more than 5 ha, the proposal falls under B1 Category as per the Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018, and requirement for EIA, EMP and Public Consultation for obtaining Environmental Clearance.

2.1   DESCRIPTION OF THE PROJECT

The proposed project is site specific and there is no additional area required for this project. There is no effluent generation/discharge from the proposed quarries.

Method is mining is common for all the proposed quarries in the cluster. Rough Stone is proposed to be excavated by opencast mechanized method involving splitting of rock mass of considerable volume from the parent rock mass by jackhammer drilling and blasting, hydraulic excavators are used for loading the Rough Stone from pithead to the needy crushers and rock breakers to avoid secondary blasting.

2.2   LOCATION OF THE PROJECT

- The proposed quarry project falls in Sathiyamangalam Village, Kulathur Taluk and Pudukkottai District.
- Thiru. C. Rengaraj Rough stone quarry cluster is located about 3.0 km Southwest side of Sathiyamangalam Village
- The Sathiyamangalam Village is located about 9 km South West of Kulathur Taluk.
- The area is marked in the Survey of India, Toposheet No. 58-J/11. The area lies between the Latitudes of 10°28'07.82"N to 10°28'12.86"N and Longitudes of 78°44'45.46"E to 78°44'50.48"E

The project does not fall within 10 km radius of any Eco – sensitive zone, National Park, Tiger Reserve, Elephant Corridor and Biosphere Reserves.

TABLE 2.1: SITE CONNECTIVITY

Nearest Roadway	NH-336 – Trichy – Pudukkottai – 4.0Km - E SH-71 – Viralimalai – Pudukkottai – 4.0Km - SW
Nearest Village	Sathiyamangalam – 1km – Northeast
Nearest Town	Pudukkottai – 13.0Km - SE
Nearest Railway	Vellanur Railway station - 5.0Km - SE
Nearest Airport	Trichy Airport – 33.0Km - N
Seaport	Thoothukudi - 200km – SW

Source: Survey of India Toposheet

TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECT

Boundary Pillar No.	Latitude	Longitude	Boundary Pillar No.	Latitude	Longitude
1	10° 28' 08.96"N	78° 44' 45.46"E	8	10° 28' 08.92"N	78° 44' 50.18"E
2	10° 28' 12.86"N	78° 44' 46.00"E	9	10° 28' 08.98"N	78° 44' 50.48"E
3	10° 28' 12.48"N	78° 44' 47.46"E	10	10° 28' 08.98"N	78° 44' 49.82"E
4	10° 28' 10.39"N	78° 44' 47.13"E	11	10° 28' 07.82"N	78° 44' 50.14"E
5	10° 28' 10.24"N	78° 44' 48.22"E	12	10° 28' 08.10"N	78° 44' 48.93"E
6	10° 28' 12.26"N	78° 44' 48.30"E	13	10° 28' 08.86"N	78° 44' 48.80"E
7	10° 28' 11.48"N	78° 44' 50.00"E			

Source: Approved Mining Plan

FIGURE 2.1: GOOGLE IMAGE OF THE PROJECT AREA
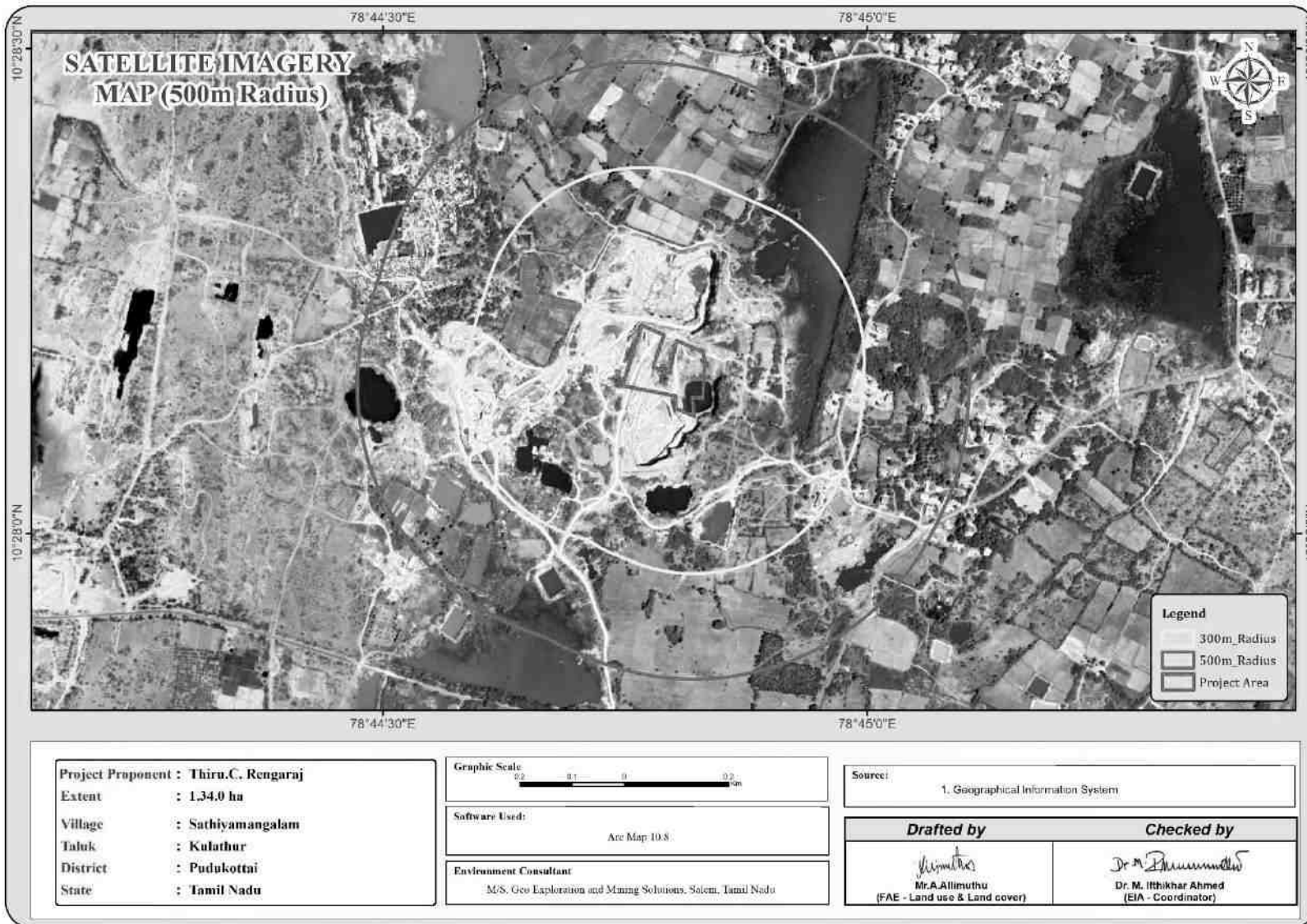
Source: Superimposed on Google Earth Imagery

FIGURE 2.2: QUARRY LEASE PLAN / SURFACE PLAN
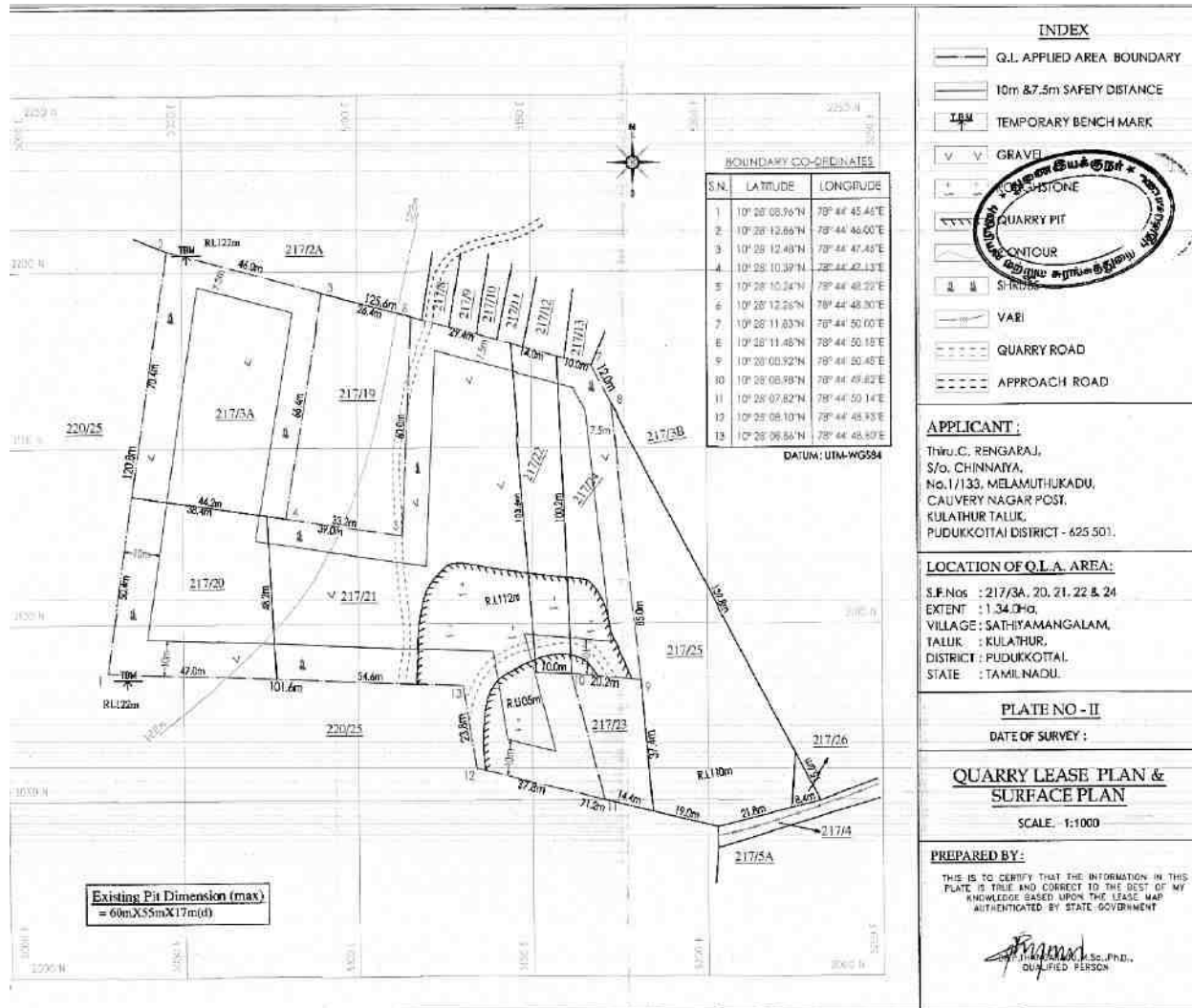
Source: Approved Mining Plan

FIGURE 2.3: PHOTOGRAPHS OF PROPOSED SITE

FIGURE 2.4: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS
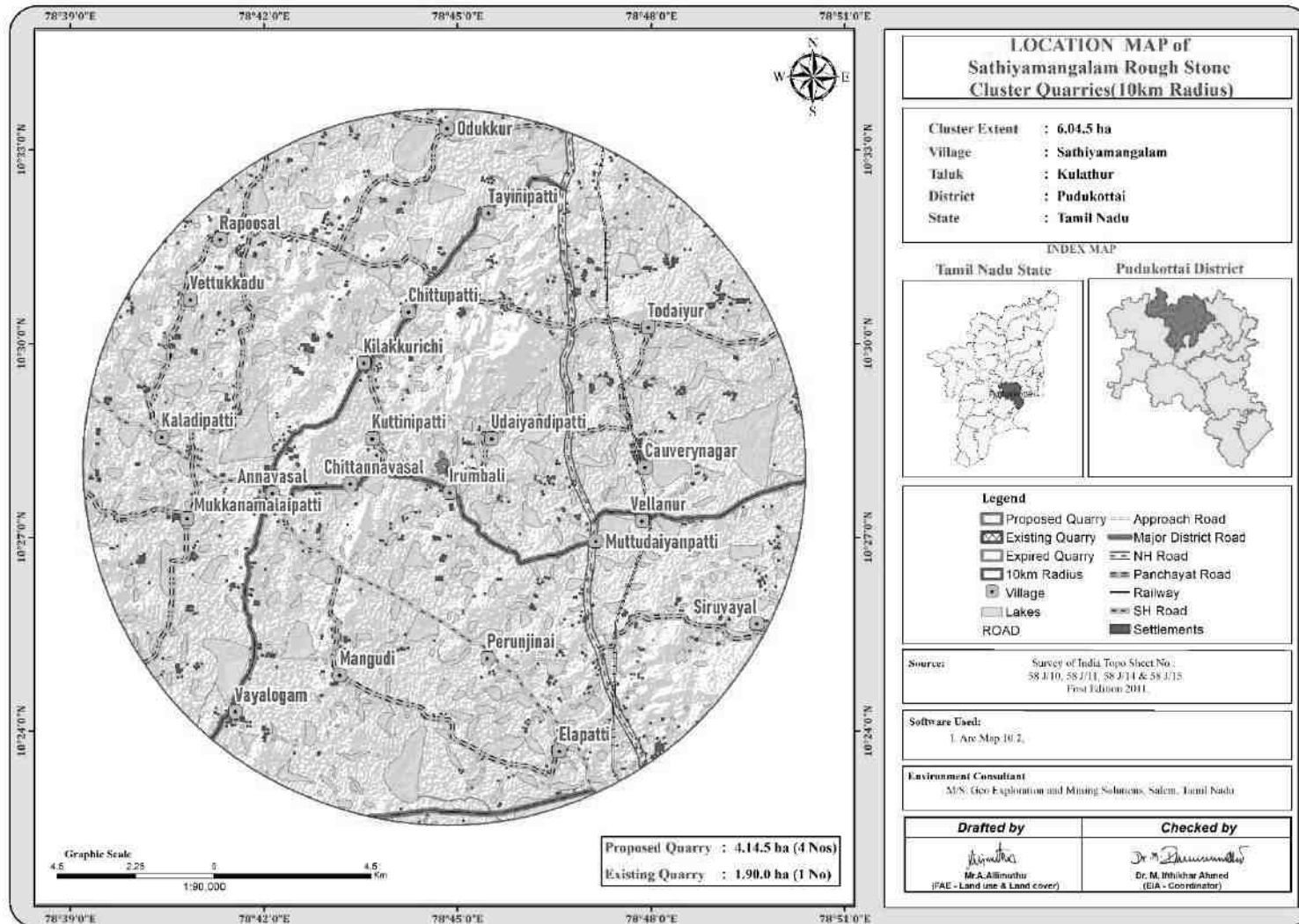
Source: Bhuvan

FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 5KM RADIUS
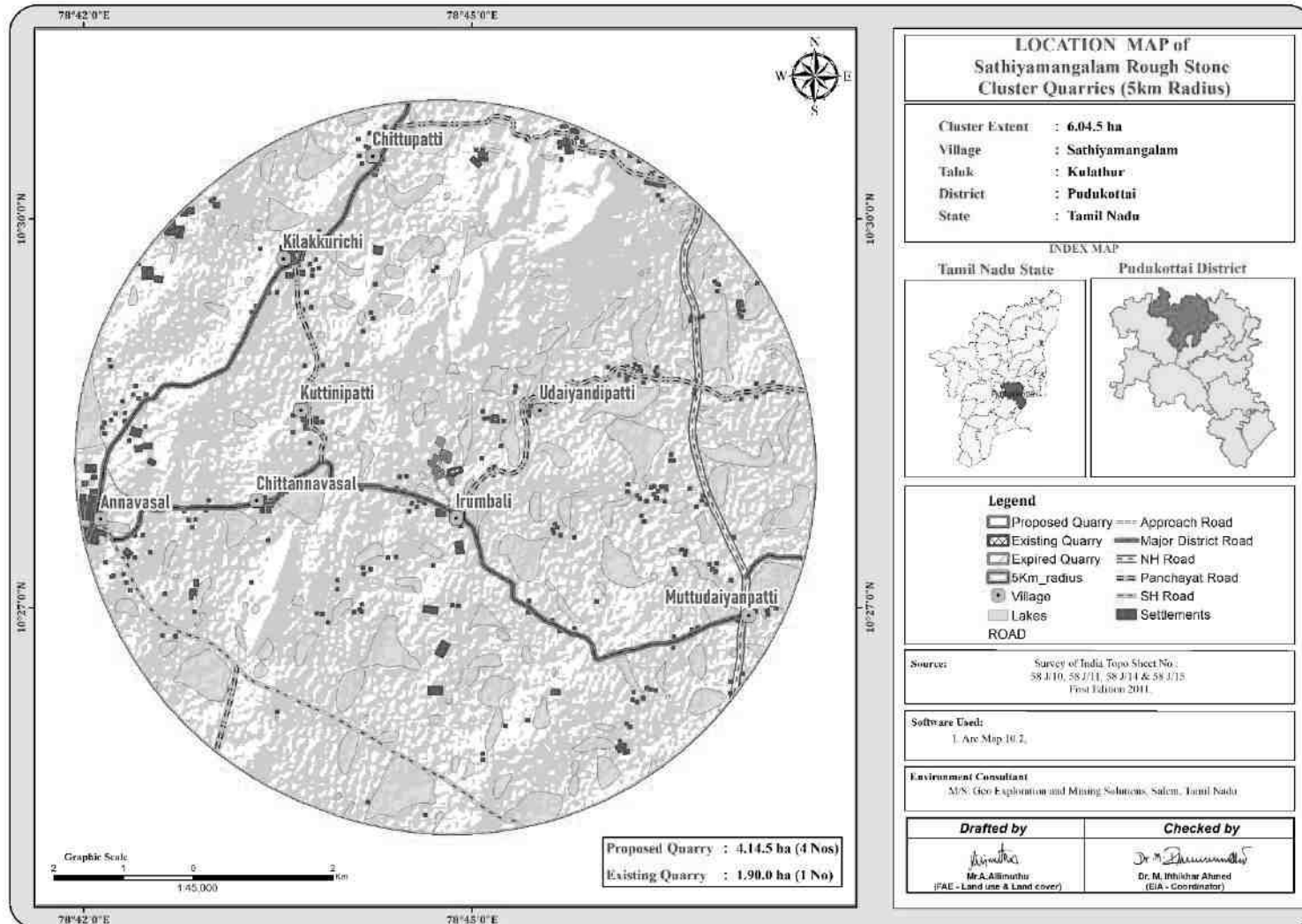
Source: Bhuvan

FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS
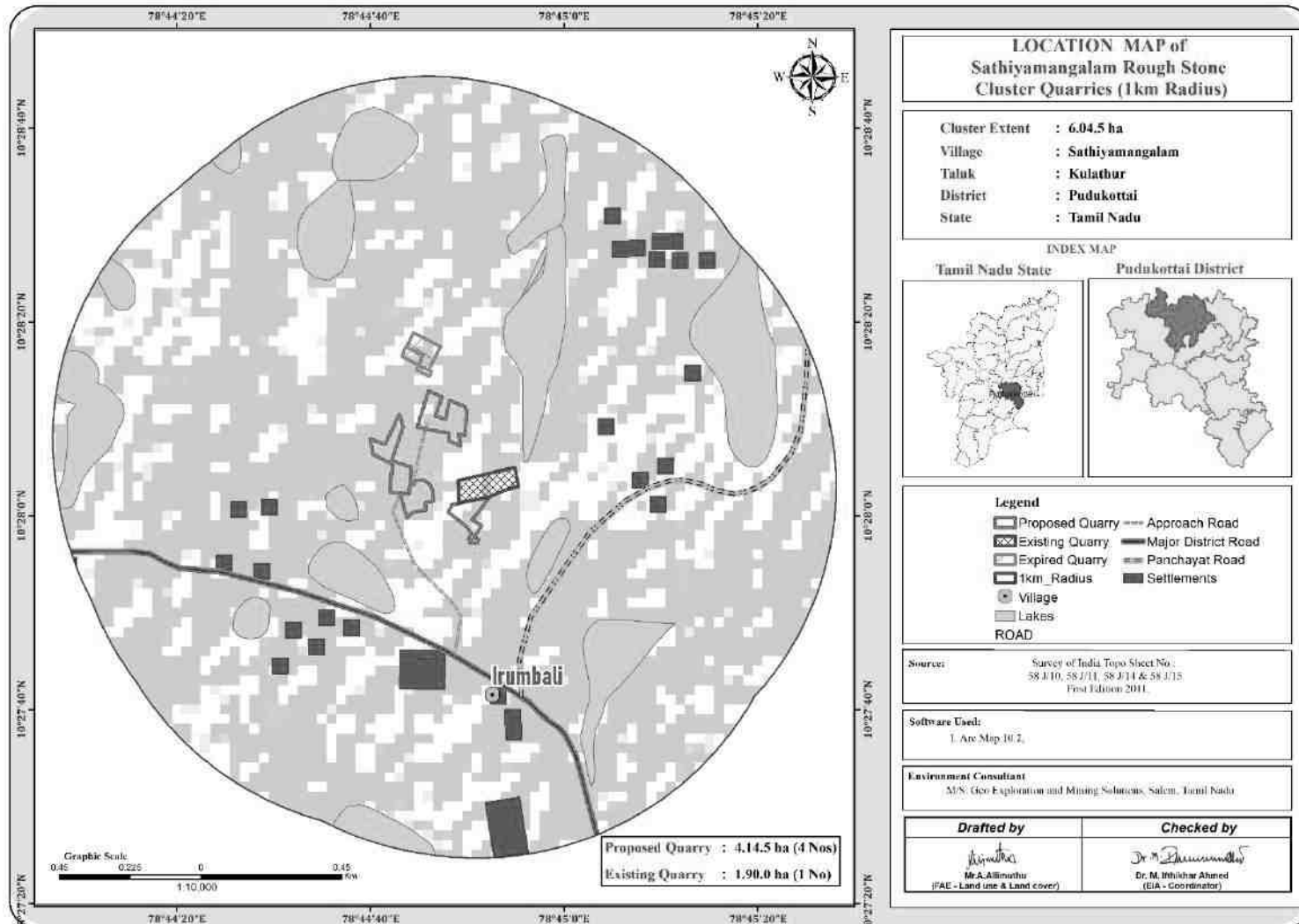
Source:Bhuvan

2.2.1   Project Area
- Proposed Project is site specific
- There is No beneficiation or processing proposed inside the project area.
- There is no forest land involved in the proposed project and is devoid of major vegetation and trees.

TABLE 2.3: LAND USE PATTERN

DESCRIPTION	PRESENT AREA IN (HA)	AREA AT THE END OF LIFE OF QUARRY (HA)
Area under quarry	0.26.0	0.92.0
Infrastructure	Nil	0.01.0
Roads	0.02.0	0.02.0
Green Belt	Nil	0.13.0
Un – utilized area	1.06.0	0.26.0
TOTAL	**1.34.0**	**1.34.0**

Source: Approved Mining Plan

2.2.2   Size or Magnitude of Operation

TABLE 2.4: OPERATIONAL DETAILS FOR PROPOSED PROJECT

PARTICULARS	DETAILS		
	Rough Stone (5Year Plan period)	Weathered rock (3 Years Plan period)	Topsoil (3 Years Plan period)
Geological Resources in m^3	3,57,660	21,044	31,380
Mineable Reserves in m^3	42,620	8,648	17,781
Production in m^3	42,620	8,648	17,781
Mining Plan Period	5 Years		
Number of Working Days	300 Days		
Production per day in m^3	28	10	20
No of Lorry loads (12m^3 per load)	3	1	2
Total Depth of Mining	30m bgl		

Source:Ps

2.3   GEOLOGY

2.3.1   Regional Geology

Peninsular gneiss forms the oldest rock formations, in which the massive formation of Charnockite lies over with rich accumulation of recent quaternary formation. On regional scale the Charnockite body N30°E to S30°W with dipping SE65°.

Stratigraphy of the area –

```
AGE                        FORMATION
Recent        -      Quaternary formation (Topsoil + Weathered rock)
    ---------Unconformity-----------
Archaean      -      Charnockite
                     Peninsular Gneiss Complex
```
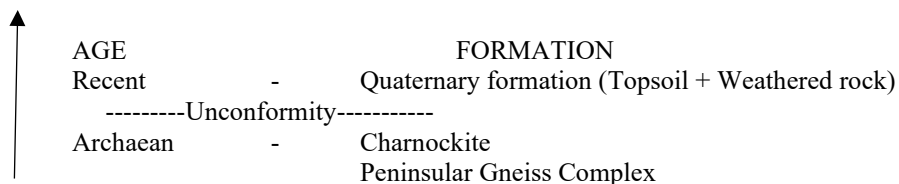
The geological formation of Pudukkottai District comprises of the hard rocks formed in the Archean age to the sedimentary deposits of the Quaternary period. Geologically the entire study area can be divided into hard rock and sedimentary rock regions. The hard rocks are found on the western side and sedimentary formation towards the eastern direction of the study area. About 45 per cent of the study area is under hard massive formation of Archean age and the rest 55 per cent comprises of the sedimentary formation ranging from Pre-Cambrian to Quaternary period. The various types of hard rocks found here are Charnockites, Hornblende Gneiss, Biotite Gneiss, Granite and Quartzite's. Various types of Gneiss rocks are found in the western part of Pudukkottai District. Charnockites

and granites rocks are mostly found in the central part including the blocks of Kunnandavarkoil, Thirumayam and the southern parts of Pudukkottai Block. The various types of Gneiss rocks are found in the western part of the study area, consisting the blocks of Viralimalai, Annavasal and Ponamaravathy. Quartzite deposits are found in small quantity in some parts of Annavasal and Thirumayam Blocks. In the Blocks of Kulathur, Thirumayam and parts of Pudukkottai crystalline rocks are found. The sedimentary deposits found in this region consist of shaly sandstone, sand, clay and gravels. The sedimentary deposits formed during the Tertiary period consist of laterite, arenaceous and argillaceous sandstone clay. These deposits are found in the Blocks of Arantangi, Gandarvakottai, Alangudi and Thiruvarankulam. Crecateous deposits consisting of clay, limestone, sand stone and clayey sand stone are found in some parts of Gandarvakottai, Thirumayam and Pudukkottai. Unconsolidated coastal alluvial deposits consisting of sand gravel and silt are found along the river bed. Silt and clay deposits of Quaternary period are found in the blocks of Avudaiyarkoil and Manalmelkudi. Sand deposits with beach ridges and dunes are identified near the coastal boundary of Pudukkottai District.

Source: District Survey Report for Minor Minerals Pudukkottai District – May 2019

https://www.tnmines.tn.gov.in/pdf/dsr/6.pdf

2.3.2   Local Geology: -

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. All the project areas are plain terrain, all the project areas are covered with topsoil formation of 3m thickness and Weathered rock of 2m thickness; Massive Charnockite formation is found after 3m of Topsoil and 2m of Weathered rock formation which is clearly inferred from the existing quarry pit.

2.3.3   Hydrogeology

The major aquifer systems in the district are constituted by weathered and fractured crystalline rocks consisting mainly hornblende gneisses, granitic gneisses and pink granites, sedimentary formations ranging in age from Cretaceous to Recent, consisting of sand stones, lime stones, shales and unconsolidated alluvium. In the former, ground water occurs under phreatic conditions in the weathered mantle at shallow depths and semiconfined conditions in the fractured systems at deeper levels, whereas in the latter, it occurs under phreatic to confined conditions depending upon the storage and conduit characterization of the confining layers.

The thickness of weathering in crystalline rock in the district ranges from less than a meter to maximum of 15.0 m bgl depending on the topography, lithology and structural features. The results of groundwater exploration indicate that there is a possibility of encountering 2 fracture zones within 50 m bgl, 2 zones in between 50 – 100 m depth and 1 fracture zone between 100 - 150 m and 150-200m depth ranges. However, all the zones may not be encountered at all places.

In case of porous formations, aquifers can be grouped into shallow aquifers with zones within the depth of 100 m bgl and deeper aquifers between the depth range of 100 – 450 m bgl. In the shallow aquifer zones, area south of Vellar has quality problem and groundwater extraction is only from beyond 100 m depth. In other places, the granular zones are present between 60 – 100 m depth. In case of deeper aquifers, the exploration has revealed that the presence of 2 to 22 aquifer zone with a total thickness varying between 21.43 and 314.5 m. The isopach contour showed an increase in thickness from less than 50 m in the northwestern part to more than 250 m in the southeastern part.

The dug wells tapping weathered formation are 12-15 m deep and can sustain a yield up to 5 lps for a pumping 2-4 hours, while the dug wells tapping the shallow aquifers in porous formations are 12 m deep and can sustain a yield of 5 lps for a pumping of 4-6 hrs.
 The shallow aquifer down to 100 m bgl are tapped with shallow tube wells with a diameter of 150 mm with depth varying between 60 – 100m and slotted pipe of length of 10 to 20m. The wells can yield between 2 to 8 lps and can sustain a pumping of 8 – 10 hrs. The deeper aquifers are yet to be tapped for irrigation purposes and only tube wells are constructed for providing drinking water supply. The depth of the wells vary between 350– 450 m bgl

with a housing diameter of 20 – 30 cm and assembly diameter of 15 – 20 cm. The wells may yield between 19 – 56 lps.

The depth to water level in the phreatic aquifer varied from 0.85 to 9.50 m bgl during premonsoon (May 2006) and from 0.58 to 6.88 m bgl during post monsoon (Jan 2007). The depth to piezometric surface varied from 1.90 to 6.60 m bgl during pre-monsoon (May 2006) and from 1.70 to 7.60 m bgl during post monsoon (Jan 2007).

TABLE 2.4A: RANGE OF AQUIFER PARAMETERS

Parameters	Range
Well yield in LPM	1-2 lpm
Transmissivity (T) m2 /day	5-25 m2 /day
Permeability (K) m/day	3-16 m/day

Source: http://nwm.gov.in/sites/default/files/Notes%20on%20Pudukottai%20District.pdf

TABLE 2.5: GROUND WATER LEVEL VARIATIONS OF PUDUKKOTTAI DISTRICT

Jan 2017	May 2017	Jan 2018	May 2018	Jan 2019	May 2019	Jan 2020	May 2020	Jan 2021	May 2021	5 Years Pre Monsoon Average	5Years Post Monsoon Average
30.2	35.5	33.8	32.2	41.0	43.9	38.7	25.3	30.3	22.3	27.0	30.4

Source: https://www.twadboard.tn.gov.in/content/Pudukkottai

FIGURE 2.7: REGIONAL GEOLOGY MAP
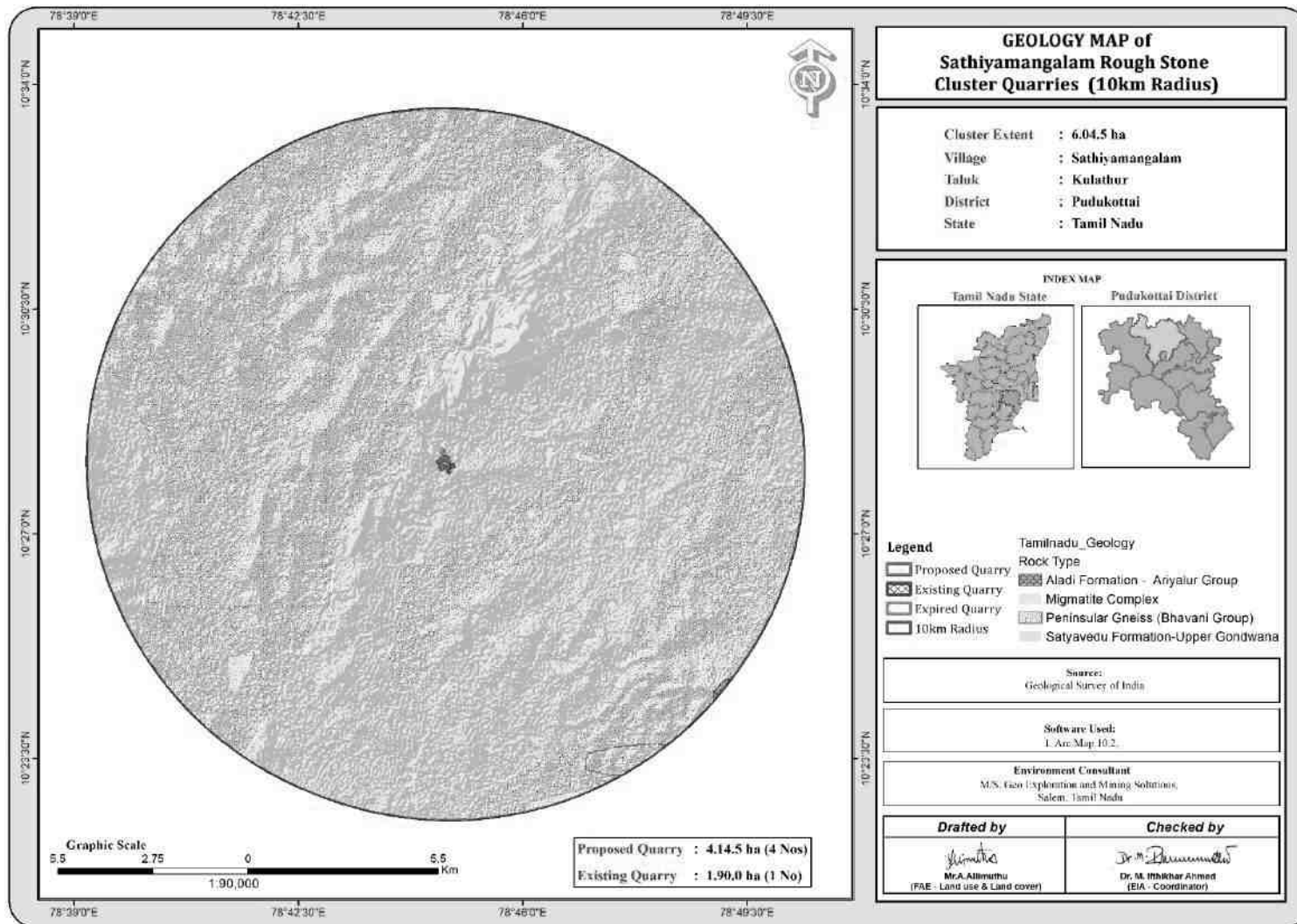
Source: From the above map it is inferred that the cluster quarries falls in the hard rock terrain (Peninsular Gneiss)

FIGURE 2.8: GEOMORPHOLOGY MAP
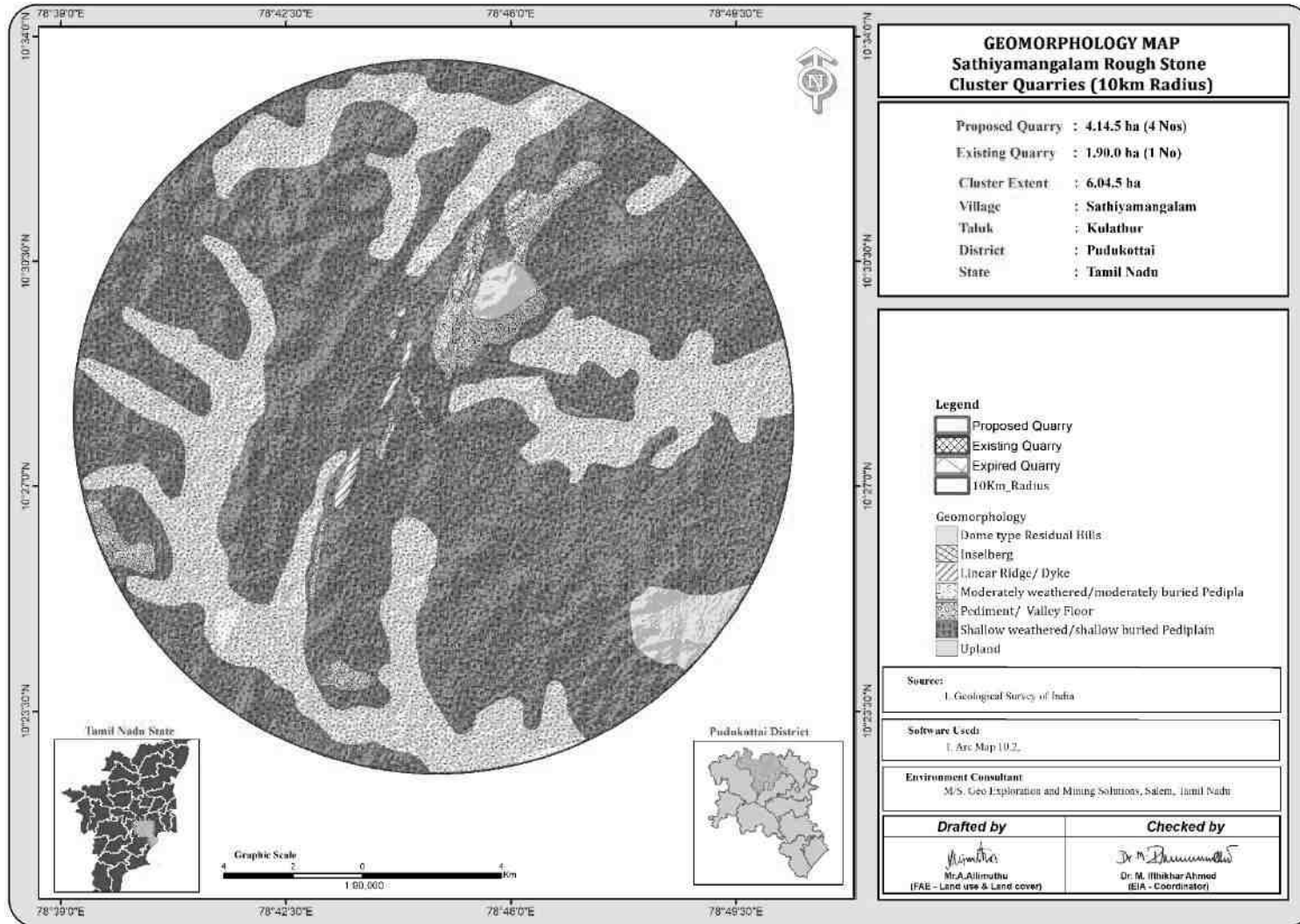
FIGURE 2.9: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS
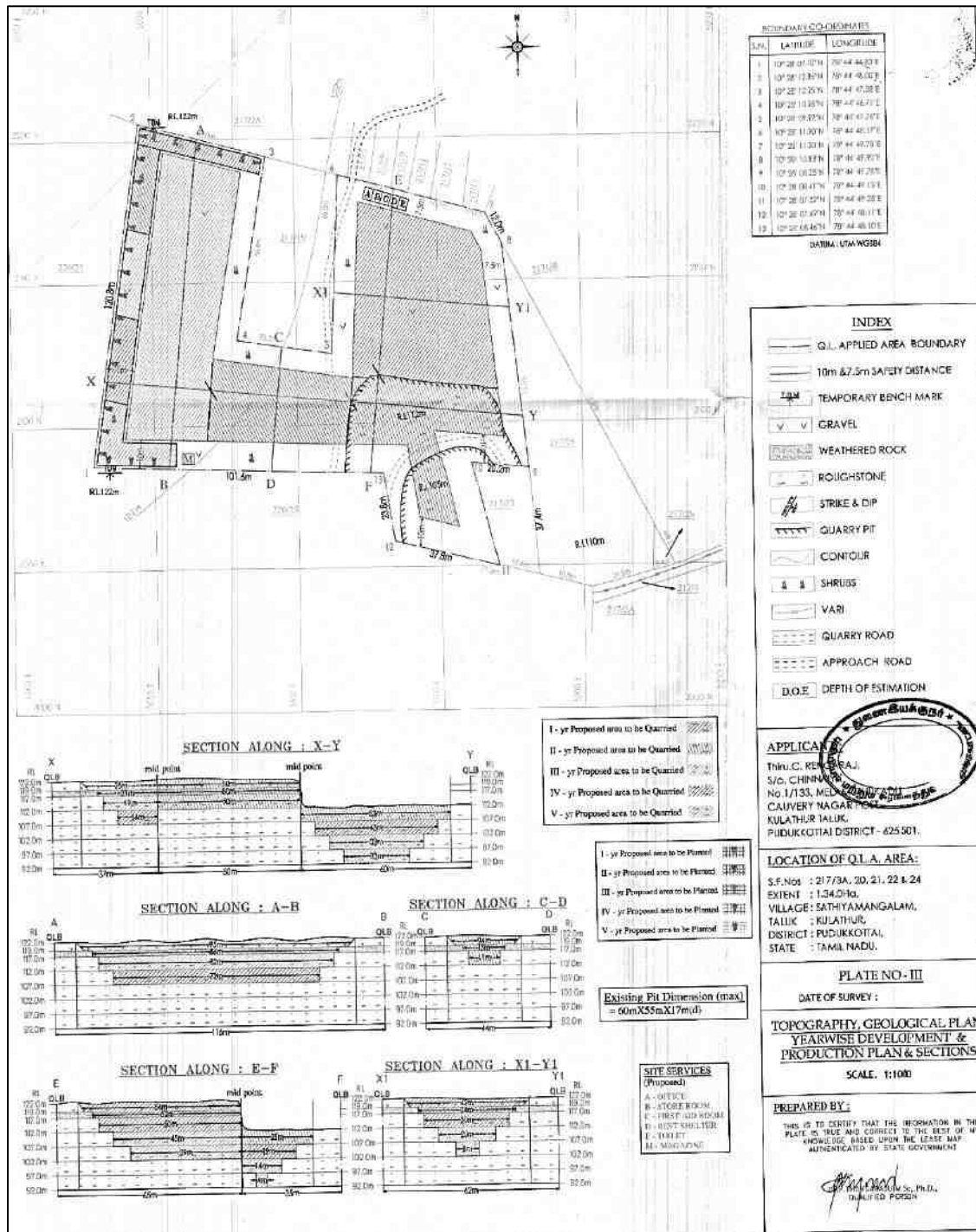
Source: Approved Mining Plan

FIGURE 2.10: CLOSURE PLAN AND SECTIONS
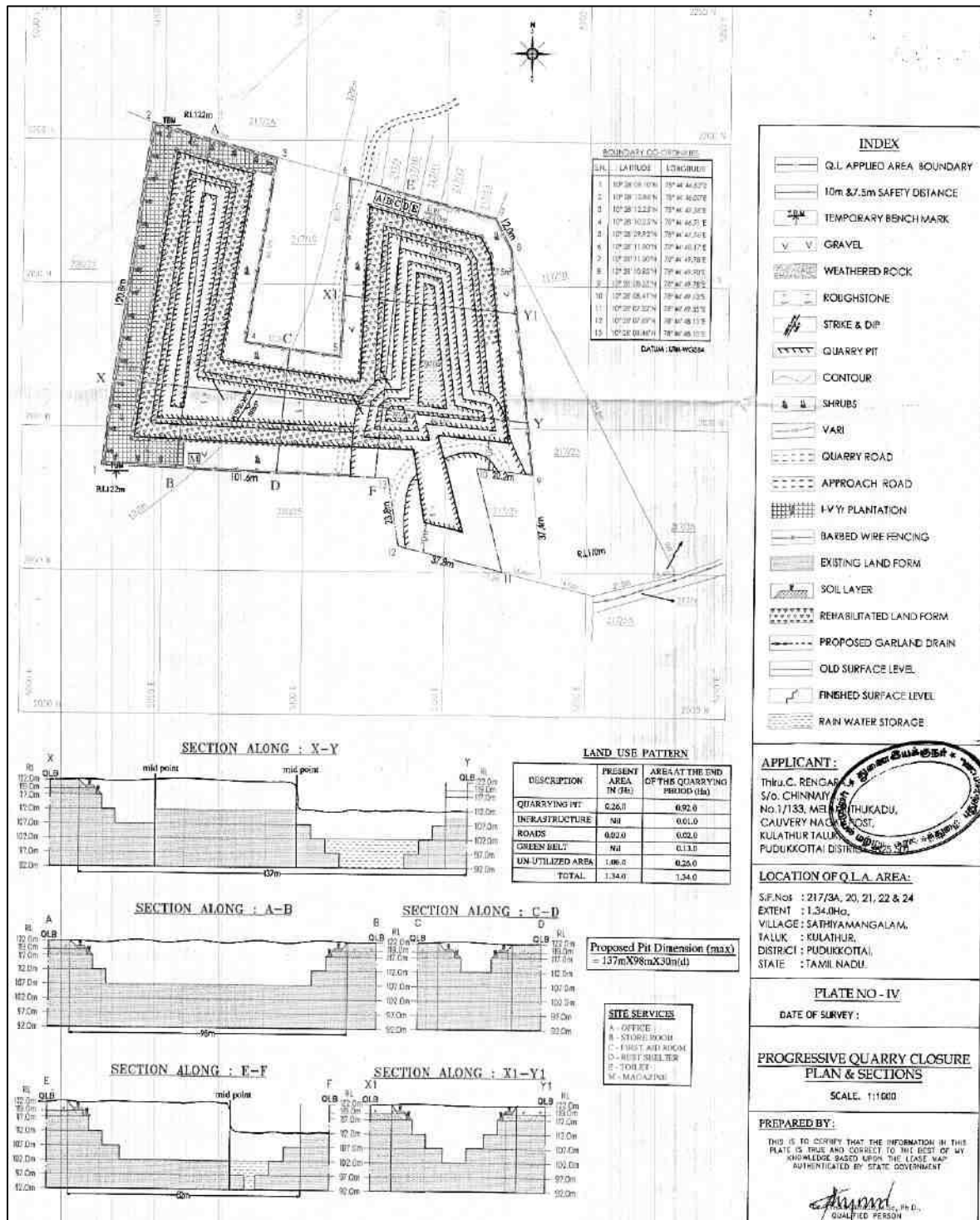
Source: Approved Mining Plan

2.4   RESOURCES AND RESERVES

The Resources and Reserves of Rough Stone were calculated based on Cross-Section Method by plotting sections to cover the maximum lease area for all the proposed projects.

Based on the availability of Geological Resources the Mineable Reserves are calculated by considering excavation system of bench formation and leaving essential safety distance of 7.5m & 10m and safety distance as per precise area communication letter and deducting the locked-up reserves during bench formation (Also called as Bench Loss) and the Mineable Reserves is calculated considering there is no waste / overburden / side burden (100% Recovery Anticipated) for all the proposed projects.

TABLE 2.6: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECT

Description	Rough Stone	Weathered rock	Topsoil
Geological Resource in m^3	3,57,660	21,044	31,380
Mineable Resource in m^3	42,620	8,648	17,781

Source: Approved Mining Plan

TABLE 2.7: YEAR-WISE PRODUCTION PLAN

YEAR	ROUGH STONE (m^3)	WEATHERED ROCK (m^3)	TOPSOIL (m^3)
I	7,500	3,536	7,056
II	9,375	1,500	3,600
III	7,790	3,612	7,125
IV	9,125	-	-
V	8,830	-	-
TOTAL	42,620	8,648	17,781

Source: Approved Mining Plan

Disposal of Waste

There is no waste anticipated in these Rough Stone quarrying operation. The entire quarried out materials will be utilized (100%). Top layer of topsoil formation will be removed and preserved for greenbelt purpose.

Conceptual Mining Plan/ Final Mine Closure Plan

The ultimate pit size is designed based on certain practical parameters such as economical depth of mining, safety zones, permissible area, etc.

TABLE 2.8: ULTIMATE PIT DIMENSION

Length (Max) (m)	Width (Max) (m)	Depth (Max)
137	98	30m bgl

Source: Approved Mining Plan

- At the end of life of mine, the excavated mine pit / void will act as artificial reservoir for collecting rain water and helps to meet out the demand or crises during drought season.
- After mine closure the greenbelt developed along the safety barrier and top benches and temporary water reservoir will enhance the ecosystem
- Mine Closure is a process of returning a disturbed site to its natural state or which prepares it for other productive uses that prevents or minimizes any adverse effects on the environment or threats to human health and safety.
- The principal closure objectives are for rehabilitated mines to be physically safe to humans and animals, geo-technically stable, geo-chemically non-polluting/ non-contaminating, and capable of sustaining an agreed post-mining land use.

Closure Objectives –

- Access to be limited, for the safety of humans and wildlife.
- The open pit mine workings and pit boundary are physically and geo-technically stable.

- Water quality in flooded pits is safe for humans, aquatic life, and wildlife.
- Discharge of contaminated drainage has been minimized and controlled.
- Original or desired new surface drainage patterns have been established.
- For flooded pits, in-pit aquatic habitat has been established where practical and feasible.
- Emergency access and escape routes from flooded pits for humans and wildlife are in place.
- Dust levels are safe for people, vegetation, aquatic life, and wildlife.

Closure Planning & Options Considerations in Mine Design –

- The closure of mine is well planned at the initial stage of planning & design consideration by the internal and external stake holders
- Construction of 2m height bund all along the mine pit boundary and ensure its stability all time & construction of garland drain along the natural slope to avoid sliding and collection of soil to the pit & surface runoff during rainfall
- After complete exploitation of mineral, the lowest bench foot wall side will be maintained as plain surface without any sump pits to avoid any accidents
- All the sharp edges will be dressed to smoother face before the closure of mine and ensure no loose debris on hanging wall side
- There is a river on southern side of the project area. The river will not be hindered by any of mine closure activities
- The project proponent as a part of social responsibilities assures to supply the stored mine pit water to the nearby villages after effective treatment process as per the standards of TNPCB & TWAD
- Native species will be planted in 3 row patterns on the boundary barriers and 1st bench, a full-time sentry will be appointed at the gate to prevent inherent entry of public & cattle.
- The access road to the quarry will be cut-off immediately after the closure
- The layout design shall be prepared and get approved from Department of Geology and Mining.
- The proponent is instructed to construct as per the layout approved
- Physical and chemical stability of structures left in place at the site, the natural rehabilitation of a biologically diverse, stable environment, the ultimate land use is optimized and is compatible with the surrounding area and the requirements of the local community, and taking the needs of the local community into account and minimizing the socio-economic impact of closure
- There will be a positive change in the environmental and ecology due to the mine closure

Closure Goal
"To return the mine site and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities." Proponents can add to this goal (with stakeholder input), provided the reclamation standard expressed in this goal is maintained or improved.

Closure Principles
These principles guide the selection of closure objectives:
• Physical Stability
• Chemical Stability
• No Long-Term Active Care
• Future Use

Component-Specific Objectives
Objectives are developed for each mine component. Examples of components include:

Open Pits | Waste Rock and Overburden Piles | Buildings and Equipment | Transportation Routes

Infrastructure | Landfills and Other Waste Disposal | Water Management Systems

Post-Closure Monitoring –

The purpose of post-closure monitoring with respect to open pit mine workings is to ensure the attainment of closure objectives.

• Monitor physical and geotechnical stability of remnant pit walls.
• Monitor the ground regime in pit walls to confirm achievement of design objectives.
• Monitor water level in pit to confirm closure objectives regarding fish, fish habitat, and wildlife safety are being achieved.
• Sample water quality and quantity at controlled pit discharge points.
• Identify and test unanticipated areas where water management is an issue.
• Inspect integrity of barriers such as berms & fences.
• Monitor wildlife interactions with barriers to determine effectiveness.
• Inspect aquatic habitat in flooded pits where applicable.
• Monitor dust levels.

TABLE 2.9: MINE CLOSURE BUDGET

Activity	Year					Cost	Total Cost
	I	II	III	IV	V		
Plantation in Nos	75	75	75	75	75	@ 100 Rs/ Saplings	Rs 37,500
Plantation cost	7500	7500	7500	7500	7500		
Plantation in the around the	75	75	75	75	75		

approach road and panchayat roads	7500	7500	7500	7500	7500		Rs 37,500
Renovation of Wire Fencing (550 meters)	1,65,000					@ 300Rs per meter	Rs 1,65,000
Renovation of Garland Drain (500 meters)	1,50,000					@ 300Rs per meter	Rs 1,50,000
TOTAL							**Rs 3,90,000**

Source: Proposed by FAE's and EC

2.5 METHOD OF MINING

Proposed Method of Mining is common for the Proposed Project – The method of mining is Opencast Mechanized Mining Method is being proposed by formation of 7.0-meter height bench with a bench width not less than the bench height. However, as far as the quarrying of Rough Stone is concerned, observance of the provisions of Regulation 106 (2) (b) as above is seldom possible due to various inherent petro genetic factors coupled with mining difficulties. Hence it is proposed to obtain relaxation to the provisions of the above regulation from the Director of Mines Safety for which necessary provision is available with the Regulation 106 (2) (b) of MMR-1961, under Mine Act – 1952.

The Rough Stone is a batholith formation and the splitting of rock mass of considerable volume from the parent rock mass will be carried out by deploying jackhammer drilling and Slurry Explosives will be used for blasting. Hydraulic Excavators attached with Rock Breakers unit will be deployed for breaking large boulders to required fragmented sizes to avoid secondary blasting and hydraulic excavators attached with bucket unit will be deployed for loading the Rough Stone into the tippers and then the stone is transported from pithead to the nearby crushers.

2.5.1 Drilling & Blasting Parameters

Drilling & Blasting will be carried out as per parameters given below: -

Spacing	–	1.2m
Burden	–	1.0 m
Depth of hole	–	1.5 m
Charge per hole	–	0.50 – 0.75kg
Powder factor	–	6.0 tonnes/kg
Diameter of hole	–	32 mm

Type of Explosives to be used –

Slurry explosives (An explosive material containing substantial portions of a liquid, oxidizers, and fuel, plus a thickener), NONEL / Electric Detonator &Detonating Fuse

Storage of Explosives –

No proposal for storage of explosives within the project area, the respective project proponents have made agreement with authorized explosives agencies for carrying out blasting activities and competent person as per DGMS guidelines will be employed for safety and supervision of overall quarrying activities.

The explosives will be sourced from the blasting agency on daily basis and the blasting will be carried out under the supervision of competent qualified Blaster and it will be ensured that there shall be no balance of explosive stock; any balance stock will be taken back by the supplier.

2.5.2 Extent of Mechanization

TABLE 2.10 PROPOSED MACHINERY DEPLOYMENT

PROPOSAL – P1				
S.NO.	TYPE	NOS	SIZE/CAPACITY	MOTIVE POWER
1	Jack hammers	2	1.2m to 2.0m	Compressed air
2	Compressor	1	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker	1	300 HP	Diesel Drive

| 4 | Trucks | 1 | 20 Tonnes | Diesel Drive |

Source: Approved Mining Plans

2.6 GENERAL FEATURES

2.6.1   Existing Infrastructures

Infrastructures like Mine office, Temporary Rest shelters for workers, Latrine and Urinal Facilities will be constructed as per the Mine Rule after the grant of quarry lease in all the proposed quarries.

2.6.2   Drainage Pattern

Drainage pattern are created by stream erosion over time that reveals characteristics of the kind of rocks and geological structures in a landscape region drained by streams.

Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin. They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land.

Dendritic patterns, which are by far the most common, develop in areas where the rock (or unconsolidated material) beneath the stream has no particular fabric or structure and can be eroded equally easily in all directions.

There are no streams, canals or water bodies crossing within the project area. The drainage pattern of the area is dendritic – sub dendritic.

2.6.3   Traffic Density

The traffic survey conducted based on the transportation route of material, the Rough Stone is proposed to be transported mainly through Muthudaiyanpatti-Annavasal Major District Road

Traffic density measurements were performed at two locations
1. Muthudaiyanpatti-Annavasal Major District Road
2. Pudukkottai – Tiruchirappalli National Highway Road

Traffic density measurement were made continuously for 24 hours by visual observation and counting of vehicles under three categories, viz., Heavy motor vehicles, light motor vehicles and two/three wheelers. As traffic densities on the roads are high, two skilled persons were deployed simultaneously at each station during each shift-one person on either direction for counting the traffic. At the end of each hour, fresh counting and recording was undertaken.

TABLE.2.11: TRAFFIC SURVEY LOCATIONS

Station Code	Road Name	Distance and Direction	Type of Road
TS1	Muthudaiyanpatti-Annavasal	650m - SE	MAJOR DISTRICT ROAD
TS2	Irumbali-Satyamangalam	3km - NE	VILLAGE ROAD

Source: On-site monitoring by GEMS FAE & TM

TABLE 2.12: EXISTING TRAFFIC VOLUME

Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	240	720	85	90	246	123	933
TS2	80	240	150	155	256	128	523

Source: On-site monitoring by GEMS FAE & TM

* PCU conversion factor: HMV (Trucks and Bus) = 3, LMV (Car, Jeep and Auto) = 1 and 2/3 Wheelers = 0.5

TABLE 2.13: ROUGH STONE HOURLY TRANSPORTATION REQUIREMENT

Transportation of Rough Stone per day		
Capacity of trucks	No. of Trips per day Cumulatively	Volume in PCU
12 tonnes	23	23

Source: Data analysed from Approved Mining Plan

FIGURE.2.11: MINERAL TRANSPORTATION ROUTE MAP
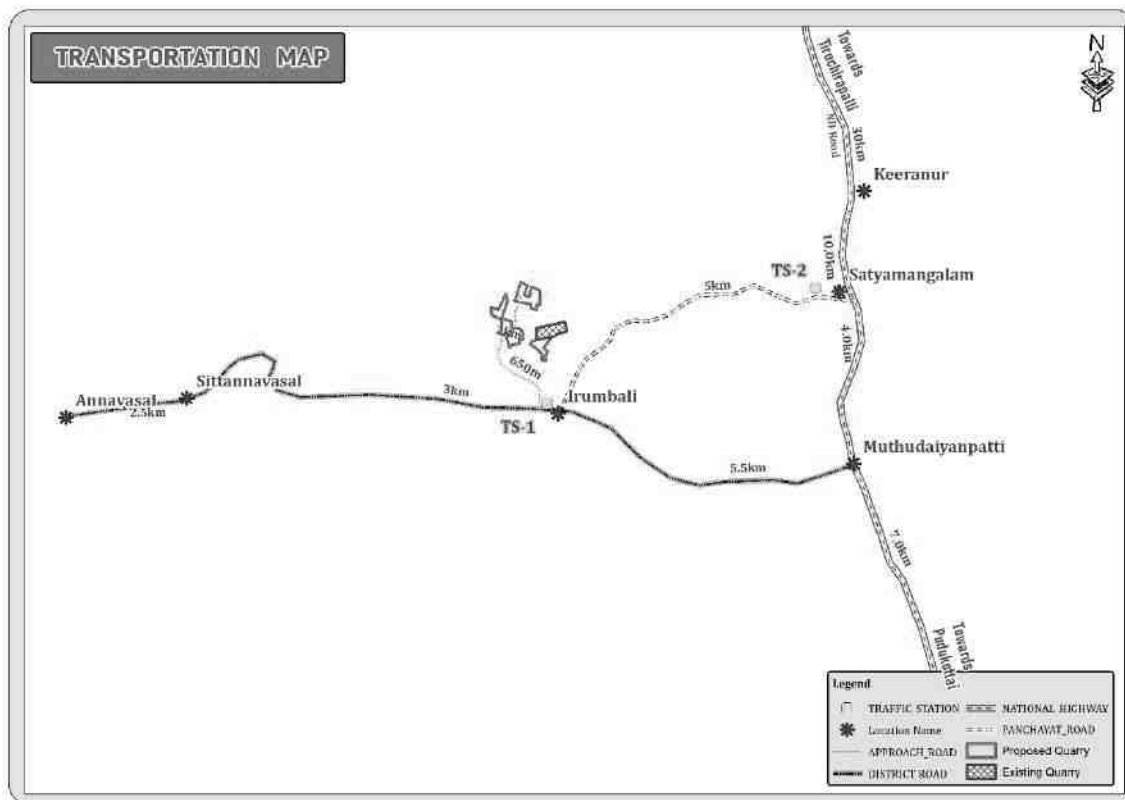
TABLE 2.14: SUMMARY OF TRAFFIC VOLUME

Route	Existing Traffic volume in PCU	Incremental traffic due to the project	Total traffic volume	Hourly Capacity in PCU as per IRC – 1960guidelines
Muthudaiyanpatti-Annavasal MDR	933	23	956	1500
Pudukkottai – Tiruchirappalli NH	523	23	546	1200

Source: On-site monitoring analysis summary by GEMS FAE & TM

- Due to these projects the existing traffic volume will not exceed
- As per the IRC 1960 this existing District Road can handle 1500 PCU in hour in hour & village road 1200 PCU hence there will not be any conjunction due to this proposed transportation.

2.6.4   Mineral Beneficiation and Processing

There is no proposal for the mineral processing or ore beneficiation in any of the proposed project

2.7 PROJECT REQUIREMENT
2.7.1   Water Source & Requirement

Detail of water requirements in KLD as given below:

TABLE 2.15: WATER REQUIREMENT

*Purpose	Quantity	Source
Dust Suppression	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	0.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.5 KLD	Water Tankers
Total	**2.0 KLD**	

Source: Prefeasibility report

* Drinking water will be sourced from Approved Water Vendors

2.7.2   Power and Other Infrastructure Requirement

No proposed project requires power supply for the mining operations. The quarrying activity is proposed during day time only (General Shift 8 AM – 5 PM, Lunch Break 1 PM – 2 PM). Electricity for use in office and other internal infrastructure will be obtained from SEB by respective project proponent.

No workshops are proposed inside the project area hence there will not be any process effluent generation from the project area. Domestic effluent from the mine office will be discharged to septic tank and soak pit. There is no toxic effluent expected to generate in the form of solid, liquid or gaseous form hence there is no requirement of waste treatment plant.

2.7.3   Fuel Requirement

High speed Diesel (HSD) will be used for mining machineries. Diesel will be brought from nearby Fuel Stations. Average diesel consumption is around   =   300 Liters of HSD / day per proposed project.

2.7.4   Project Cost

TABLE 2.16: PROJECT COST OF PROPOSED PROJECT

Project Cost	Rs.26,93,000/-

Source: Approved Mining Plan &Prefeasibility Report

2.8   EMPLOYMENT REQUIREMENT:

The following manpower's are proposed in the mining plan to carry out the day-to-day quarrying activities, the same employment is maintaining aimed at the proposed production target and also to comply with the statutory provisions of The Metalliferous mines regulations, 1961 for the proposed project.

TABLE 2.17: PROPOSED MANPOWER DEPLOYMENT

PROPOSAL	
Mines Manager/Mines Foreman	1
Mate/Blaster	1
Excavator Operator & Drivers	2
Jack hammer operator	4
Watchman/Security	1
Labour Helper	3
Co-operator and Cleaner	2
Total	**14**

Source: Approved Mining Plans of respective Project

2.9   PROJECT IMPLEMENTATION SCHEDULE

The commercial operation will commence after the grant of Environmental Clearance. CTO will be obtained from the Tamil Nadu State Pollution Control Board. The conditions imposed during the Environmental Clearance will be compiled before the start of mining operation.

TABLE 2.18: EXPECTED TIME SCHEDULE

Sl.No.	Particulars	Time Schedule (In Month)					Remarks if any
		1st	2nd	3rd	4th	5th	
1	Environmental Clearance						
2	Consent to Operate						Production Start Period
Time line may vary; subjected to rules and regulations /& other unforeseen circumstances							

Source: Anticipated based on Timelines framed in EIA Notification & CPCB Guidelines

3.   DESCRIPTION OF ENVIRONMENT

3.0   GENERAL

This chapter presents a regional background to the baseline data at the very onset, which will help in better appreciation of micro-level field data, generated on several environmental and ecological attributes of the study area. The baseline status of the project environment is described section wise for better understanding of the broad-spectrum conditions. The baseline environment quality represents the background environmental scenario of various environmental components such as Land, Water, Air, Noise, Biological and Socio-economic status of the study area. Field monitoring studies to evaluate the base line status of the project site were carried out covering March, April & May 2022 with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by Chennai Mettex lab private Limited– Approved by AAI, AGMARK, APEDA, BIS, [IC, FSSAI, GAFTA, IOPEPC, MOEF & TEA BOARD, for the below attributes –

- o   Land
- o   Water
- o   Air
- o   Noise
- o   Biological
- o   Socio-economic status

Study Area

An area of 10 km radius (aerial distance) from the periphery of the cluster is considered for EIA study. The data collection has been used to understand the existing environment scenario around the cluster against which the potential impacts of the project can be assessed. The study area has been divided into two zones viz **core zone** and **buffer zone** where core zone is considered as cluster and buffer zone taken as 10km radius from the periphery of the Cluster. Both Core zone and Buffer zone is taken as the study area.

Study Period

The baseline study was conducted during the Pre-monsoon season i.e., March to May 2022.

Study Methodology

- The project area was surveyed in detail with the help of Total Station and the boundary pillars were picked up with the help of GPS. The boundary coordinates were superimposed on the satellite imagery to understand the relief of the area, besides Land use pattern of the area was studied through the Bhuvan (ISRO)
- Soil samples were collected and analysed for relevant physio-chemical characteristics, exchangeable Cations, nutrients & micro nutrients etc., in order to assess the impact due to mining activities and to recommend saplings for Greenbelt development
- Ground water samples were collected during the study period from the existing bore wells, while surface water was collected from ponds in the buffer zone. The samples were analysed for parameters necessary to determine water quality (based on IS: 10500:2012 criteria) and those which are relevant from the point of view of environmental impact of the proposed mines
- A onsite meteorological station was setup in cluster area, to collect data about wind speed, wind direction, temperature, relative humidity, rainfall and general weather conditions were recorded throughout the study period
- In order to assess the Ambient Air Quality (AAQ), samples of ambient air were collected by installation of Respiratory Dust Samplers (RDS) for Fugitive dust, PM_{10} and SO_2, NO_X with gaseous attachments & Fine

Dust Samplers (FDS) for PM$_{2.5}$ and other parameters as per NAAQ norms and analysed for primary air pollutants to work out the existing status of air quality.

- The Noise level measurements were also made at various locations in different intervals of time with the help of sound level meter to establish the baseline noise levels in the impact zone.
- Baseline biological studies were carried out to assess the ecology of the study area to study the existing flora and fauna pattern of the area.
- Socio-Economic survey was conducted at village and household level in the study area to understand the present socio-economic conditions and assess the extent of impact due to the proposed mining project.

The sampling methodologies for the various environmental parameters required for the study, frequency of sampling, method of samples analysis, etc., are given below Table 3.1.

TABLE 3.1: MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING

Attribute	Parameters	Frequency of Monitoring	No. of Locations	Protocol
Land-use Land cover	Land-use Pattern within 10 km radius of the study area	Data from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio-Chemical Characteristics	Once during the study period	6 (1 core & 5 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (1 surface water & 5 ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
*Ambient Air Quality	PM10 PM2.5 SO2 NOX Fugitive Dust	24 hourly twice a week (March – May 2019)	8 (1 core & 7 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
*Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	8 (1 core & 6 buffer zone)	IS 9989 As per CPCB Guidelines
Ecology	Existing Flora and Fauna	Through field visit during the study period	Study Area	Primary Survey by Quadrate & Transect Study Secondary Data – Forest Working Plan
Socio Economic Aspects	Socio–Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

Source: On-site monitoring/sampling by Enviro-Tech Services Laboratories in association with GEMS

* All monitoring and testing has been carried out as per the Guidelines of CPCB and MoEF & CC.

3.1 LAND ENVIRONMENT

The main objective of this section is to provide a baseline status of the study area covering 10km radius around the proposed mine site so that temporal changes due to the mining activities on the surroundings can be assessed in future.

3.1.1 Land Use/ Land Cover

A visual interpretation technique has been adopted for land use classification based on the keys suggested in the chapter – V of the guidelines issued by NNRMS Bangalore & Level III classification with 1:50,000 scale for the preparation of land use mapping. Land use pattern of the area was studied through LISS III imagery of Bhuvan (ISRO). The 10 km radius map of study area was taken for analysis of Land use cover.

TABLE 3.2: LAND USE / LAND COVER TABLE 10 KM RADIUS

S.No	CLASSIFICATION	AREA_HA	AREA_%
	BUILTUP		
1	URBAN	360.48	1.09
2	RURAL	502.20	1.52
3	MINING	327.16	0.99
	AGRICULTURAL LAND		
4	CROP LAND	20675.04	62.78
5	PLANTATION	355.13	1.08
6	FALLOW LAND	3924.15	11.91
	FOREST		
7	FOREST DECIDUOUS	186.34	0.57
8	SCRUB FOREST	750.37	2.28
9	FOREST PLANTATION	331.14	1.01
	BARREN/WASTE LANDS		
10	SALT AFFECTED LAND	300.77	0.91
11	SCRUB LAND	763.78	2.32
12	BARREN ROCKY	37.42	0.11
	WETLANDS/ WATER BODIES		
13	WATER BODIES/LAKE	4421.04	13.42
	TOTAL	32935.00	100.00

Source: Survey of India Toposheet and Landsat Satellite Imagery

FIGURE 3.1: PIE DIAGRAM OF LAND USE AND LAND IN STUDY AREA

Area %

■ URBAN	
■ RURAL	
■ MINING	
■ CROP LAND	
■ PLANTATION	
■ FALLOW LAND	
■ FOREST DECIDUOUS	
■ SCRUB FOREST	
■ FOREST PLANTATION	
■ SALT AFFECTED LAND	
■ SCRUB LAND	
■ BARREN ROCKY	
■ WATER BODIES/LAKE	
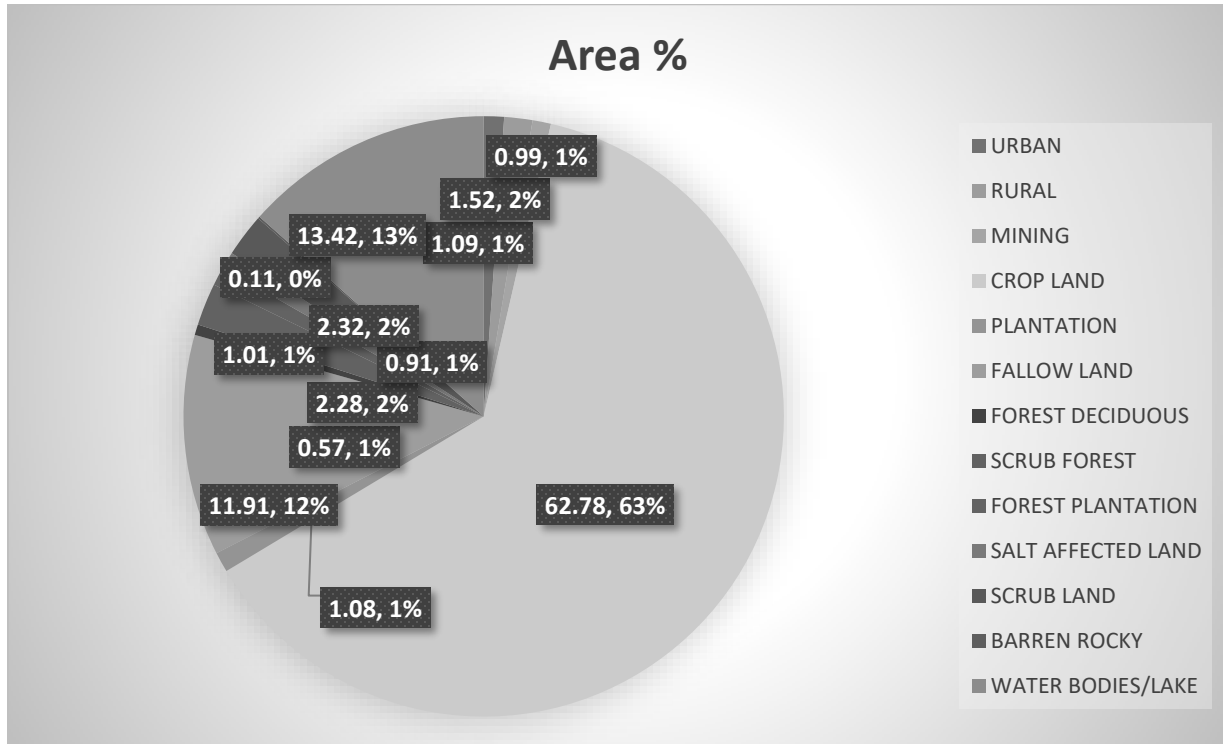
Source: Table 3.1

FIGURE 3.2: LAND USE LAND COVER MAP 10KM RADIUS

S.No	CLASSIFICATION	AREA_HA	AREA_%
	BUILT UP		
1	URBAN	360.48	1.09
2	RURAL	502.20	1.52
3	MINING	327.16	0.99
	AGRICULTURAL LAND		
4	CROP LAND	20675.04	62.78
5	PLANTATION	355.13	1.08
6	FALLOW LAND	3924.15	11.91
	FOREST		
7	FOREST DECIDUOUS	186.34	0.57
8	SCRUB FOREST	750.37	2.28
9	FOREST PLANTATION	331.14	1.01
	BARREN/WASTE LANDS		
10	SALT AFFECTED LAND	300.77	0.91
11	SCRUB LAND	763.78	2.32
12	BARREN ROCKY	37.42	0.11
	WETLANDS/ WATER BODIES		
13	WATER BODIES/LAKE	4421.04	13.42
	TOTAL	32935.00	100.00

Cluster Extent : 6,04.5 ha
Village : Sathiyamangalam
Taluk : Kulathur
District : Pudukottai
State : Tamil Nadu

Proposed Quarry : 4.14.5 ha (4 Nos)
Existing Quarry : 1.90.0 ha (1 No)

From the above table, pie diagram and land use map it is inferred that the majority of the land in the study area is Agriculture land (includes crop land, plantation & fallow land) 75.77% followed by Built-up Lands (includes Urban & Rural) 2.61%, Barren Land 3.34%; Water bodies 13.42% and Mining – 0.99%.

The total mining area within the study area is 327.16 ha i.e., 0.99%. The cluster area of 9.23.5 ha contributes about 1.84% of the total mining area within the study area. This small percentage of Mining Activities shall not have any significant impact on the environment.

3.1.2   Topography

The proposed project area is plain terrain, covered with topsoil formation of 3m thickness and weathered rock of 2m thickness; Massive Charnockite formation is found after 3m topsoil formation and 2m weathered rock formation which is clearly inferred from the existing quarry pits.

3.1.3   Drainage Pattern of the Area

Drainage pattern are created by stream erosion over time that reveals characteristics of the kind of rocks and geological structures in a landscape region drained by streams.

Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin. They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land.

Dendritic patterns, which are by far the most common, develop in areas where the rock (or unconsolidated material) beneath the stream has no particular fabric or structure and can be eroded equally easily in all directions.

There are no streams, canals or water bodies crossing within the project area. The drainage pattern of the area is dendritic – sub dendritic.

3.1.4   Seismic Sensitivity

The proposed project site falls in the seismic Zone III, low damage risk zone as per BMTPC, Vulnerability Atlas of Seismic zone of India IS: 1893 – 2002. The project area falls in the hard rock terrain on the peninsular shield of south India which is highly stable.
(Source: https://moes.gov.in/writereaddata/files/LS_EN_20032020_385.pdf)

3.1.5   Environmental Features in the Study Area

There is no Wildlife Sanctuaries, National Park and Archaeological monuments within project area. No Protected and Reserved Forest area is involved in the project area. Therefore, there will be no need to acquisition/diversion of forest land. The details related to the environment sensitivity around the proposed mine lease area i.e. 10 km radius, are given in the below Table 3.3.

TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER

Sl.No	Sensitive Ecological Features	Name	Arial Distance in km from Cluster
1	National Park / Wild life Sanctuaries	None	Nil within 10km Radius
2	Reserve Forest	None	Narthamalai RF 1.1km – NE
3	Lakes/Reservoir/ Dams/Stream/Rivers	None	Nil within 10km Radius
4	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10Km Radius
5	Critically Polluted Areas	None	Nil within 10km Radius
6	Mangroves	None	Nil within 10km Radius
7	Mountains/Hills	None	Nil within 10km Radius
8	Notified Archaeological Sites	None	Nil within 10km Radius
9	Industries/ Thermal Power Plants	None	Nil within 10km Radius
10	Defence Installation	None	Nil within 10km Radius

Source: Survey of India Toposheet

TABLE 3.4: NEARBY WATER BODIES FROM THE PROPOSED PROJECT SITE

No	Name	Distance	Direction
1	Vari	30m	Southeast
2	Tank	120m	East
3	Tank	400m	Southwest
4	Panangudi Periyakulam	4.2km	Southwest
5	Annavasal Periyakulam Lake	4.7km	West

Source: Village Cadastral Map and Field Survey

3.1.6   Soil Environment

Soil quality of the study area is one of the important components of the land environment. The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are detailed in Table 3.6 and Figure 3.3.

The objective of the soil sampling is -

To determine the baseline soil characteristics of the study area; study the impact of proposed activity on soil characteristics and study the impact on soil more importantly agriculture production point of view.

TABLE 3.5: SOIL SAMPLING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Project Area	South	10°28'09.80"N 78°44'47.56"E
2	S-2	Sathyamangalam	2.6km NE	10°28'44.40"N 78°46'09.28"E
3	S-3	Muthudaiyanpatti	4.5km SE	10°26'57.94"N 78°47'17.55"E
4	S-4	Oorapatti	3.3km North	10°30'00.41"N 78°44'56.39"E
5	S-5	Irambali	2.0km NW	10°28'29.55"N 78°43'40.06"E
6	S-6	Madiyanallur	2.0km SW	10°26'59.34"N 78°44'29.99"E

Source: On-site monitoring/sampling by Enviro-Tech Services Laboratories in association with GEMS

Methodology –

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the project site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Six (6) locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.5.

TABLE 3.6: METHODOLOGY OF SAMPLING COLLECTION

Particulars	Details
Frequency	One grab sample from each station-once during the study period
Methodology	Composite grab samples of the topsoil were collected from 3 depths, and mixed to provide a representative sample for analysis. They were stored in airtight Polythene bags and analysed at the laboratory.

Source: On-site monitoring/sampling by Enviro-Tech Services Laboratories in association with GEMS

Soil Testing Result –

The samples were analysed as per the standard methods prescribed in "Soil Chemical Analysis (M.L. Jackson, 1967) & Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India". The important properties analysed for soil are bulk density, porosity, infiltration rate, pH and Organic matter, kjeldahi Nitrogen, Phosphorous and Potassium. The standard classifications of soil and physico-chemical characteristics of the soils are presented below in Table 3.6 & Test Results in Table 3.7.

FIGURE 3.3: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS
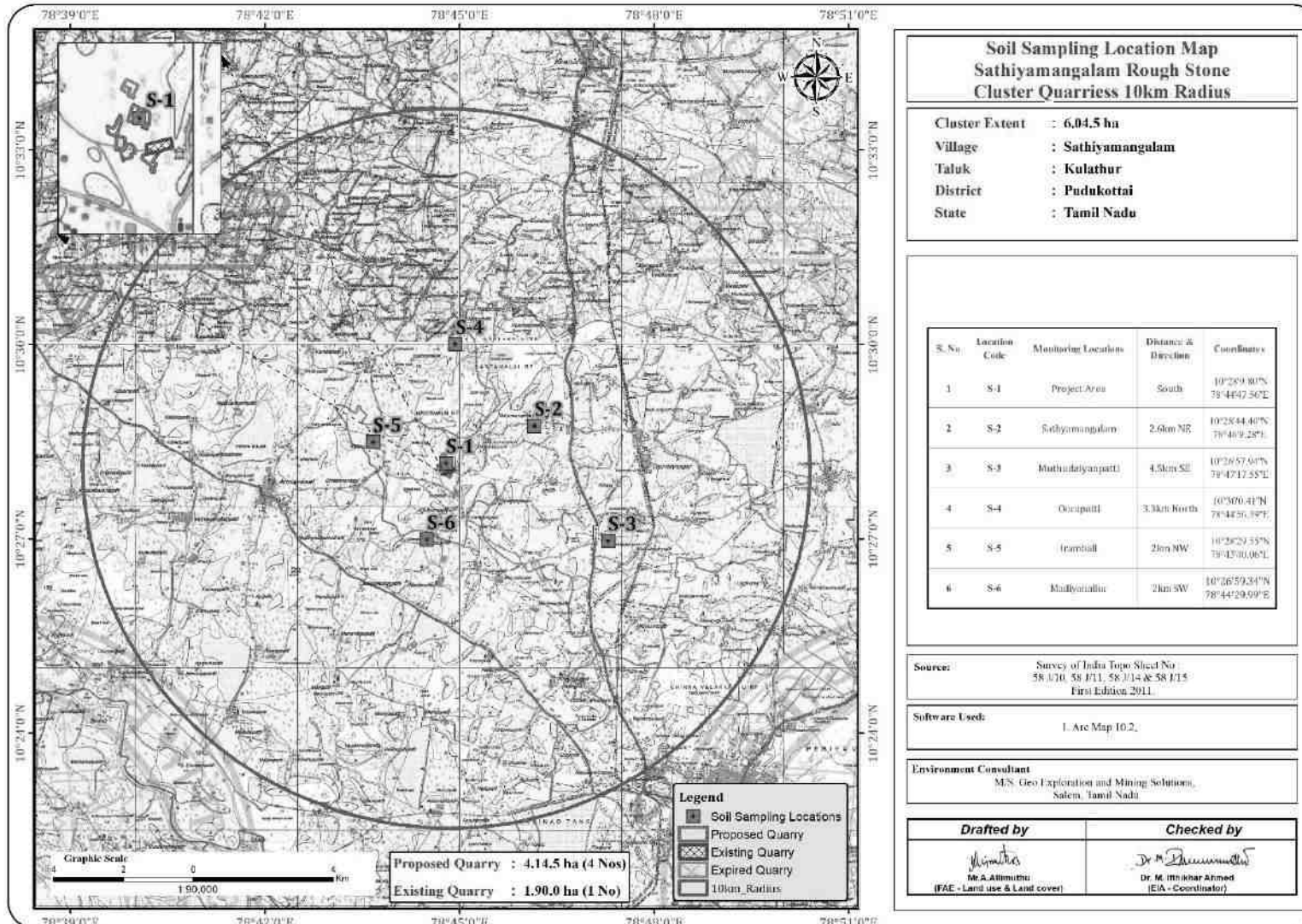
FIGURE 3.4: SOIL MAP
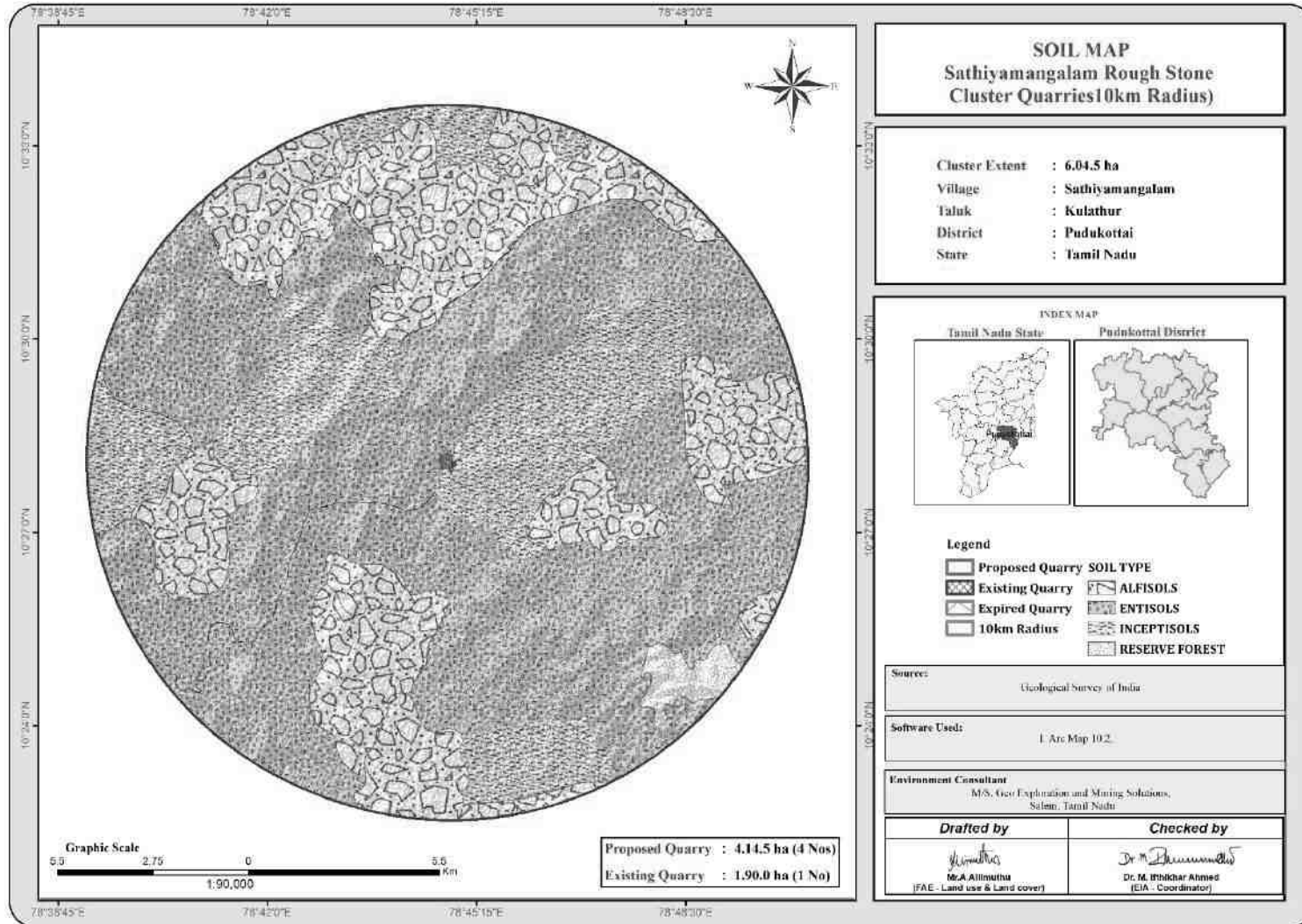
TABLE 3.7: SOIL QUALITY OF THE STUDY AREA

	Parameter	Unit	S-1 Project Area	S-2 Sathyamangalam	S-3 Muthudaiyanpatti	S-4 Oorapatti	S-5 Irambali	S-6 Madiyanallur
1	pHat27°C	-	8.40	8.04	8.72	7.62	8.10	8.30
2	ElectricalConductivityat25°C	μs/cm	652	628	537	594	602	620
3	Texture	-	Clay Loam					
4	Clay	%	45.8	34.6	45.6	42.6	36.4	38.2
5	Sand	%	30.2	32.4	32.8	28.2	41.2	42.6
6	Silt	%	24.0	33.0	21.6	29.2	22.4	19.2
7	Water Holding Capacity	%	48.6	51.7	46.4	48.2	48.4	45.6
8	Bulk Density	g/cc	1.21	1.12	1.18	1.24	1.15	1.26
9	Porosity	%	39.4	36.4	32.4	35.2	40.2	38.4
10	Exchangeable Calcium(asCa)	mg/Kg	172	198	184	210	258	241
11	Exchangeable Magnesium(asMg)	mg/Kg	52	35.4	32.2	165	144	130
12	Exchangeable Manganese(asMn)	mg/Kg	34.8	34.2	36.4	38.2	31.8	28.4
13	Exchangeable Zinc as Zn	mg/Kg	0.81	1.20	1.17	1.14	1.03	1.13
14	Available Boron (as B)	mg/Kg	0.74	1.02	1.30	1.08	1.50	1.62
15	Soluble Chloride(as Cl)	mg/Kg	178	168	160	152	174	180
16	Soluble Sulphate(as S04)	mg/Kg	0.013	0.015	0.011	0.012	0.012	0.011
17	Available Potassium(as K)	mg/Kg	43.8	41.6	40.8	32.5	40.2	38.4
18	Available Phosphorous(as P)	Kg/hec	1.24	1.68	1.52	1.18	1.26	1.32
19	Available Nitrogen(as N)	Kg/hec	184	188	180	180	160	170
20	Cadmium (as Cd)	mg/Kg	BDL (DL :1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)
21	Chromium (asCr)	mg/Kg	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)
22	Copper(asCu)	mg/Kg	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)	BDL (DL : 1.0)
23	Lead (asPb)	mg/Kg	0.58	0.65	0.64	0.62	0.60	0.48
24	Total Iron	mg/Kg	3.8	1.8	1.8	1.9	3.82	2.70
25	Organic Matter	%	2.84	3.2	2.62	2.81	3.51	2.83
26	Organic Carbon	%	1.65	1.76	1.52	1.64	2.03	1.62
27	CEC	meq/l00g	45.6	43.8	36.6	40.2	38.6	37.4

Source: Sampling Results by Enviro-Tech Services Laboratories

Interpretation & Conclusion
Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is Clay Loam Soil and Bulk Density of Soils in the study area varied between 1.12 - 1.26 g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e. ranging from 32.4 – 40.2%.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 7.62 to 8.72
- The available Nitrogen content range between 160 to 188 kg/ha
- The available Phosphorus content range between 1.18 to 1.68 kg/ha
- The available Potassium range between 32.5 to 43.8 mg/kg

3.2 WATER ENVIRONMENT

The water resources, both surface and groundwater play a significant role in the development of the area. The purpose of this study is to assess the water quality characteristics for critical parameters and evaluate the impacts on agricultural productivity, domestic community usage, recreational resources and aesthetics in the vicinity. The water samples were collected and transported as per the norms in pre-treated sampling cans to laboratory for analysis.

3.2.1 Surface Water Resources:

There is no major surface water body in the study area and the rainfall over the area is moderate, the rainwater storage in open wells and trenches are in practice over the area and the stored water acts as source of drinking water for few months after rainy season.

3.2.2 Ground Water Resources:

Groundwater occurs in all the crystalline formations of oldest Achaeans and Recent Alluvium. The occurrence and behaviour of groundwater are controlled by rainfall, topography, geomorphology, geology, structures etc.

Ground water is occurring in pheratic conditions in weathered and fractured gneiss rock formation. The weathering is controlled by the intensity of weathering and fracturing. Dug wells as wells as bore wells are more common ground water abstraction structures in the area. The diameter of the dug well is in the range of 7 to 10 m and depth of dug wells range from 8 to 11 m bgl. The dug wells yield up to 1 lps in summer months and few wells remains dry. The yield is adequate for irrigation for one or two crops in monsoon period.

3.2.3 Methodology

Reconnaissance survey was undertaken and monitoring locations were finalized based on;

- Drainage pattern;
- Location of Residential areas representing different activities/likely impact areas; and
- Likely areas, which can represent baseline conditions

Two (2) surface water and Four (4) ground water samples were collected from the study area and were analysed for physio-chemical, heavy metals and bacteriological parameters in order to assess the effect of mining and other activities on surface and ground water. The samples were analysed as per the procedures specified by CPCB, IS-10500:2012 and 'Standard methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA). The water sampling locations are given in Table 3.9 and shown as Figure 3.6.

TABLE 3.8: WATER SAMPLING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	SW-1	Near Project area	400m NE	10°28'22.45"N 78°44'56.10"E
2	SW-2	Lake Near Cauvery Nagar	6.2km – East	10°28'14.01"N 78°48'16.13"E
3	WW-1	Near Project Area	250m North	10°28'21.00"N 78°44'47.68"E
4	WW-2	Oorapatti	3.3km North	10°30'02.01"N 78°44'47.95"E
5	BW-1	Irambali	1.8km NW	10°28'27.04"N 78°43'47.89"E
6	BW-2	Muthudaiyanpatti	4.7km SE	10°26'59.22"N 78°47'08.66"E

Source: On-site monitoring/sampling by Chennai Mettex Laboratories in association with GEMS

FIGURE 3.5: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS
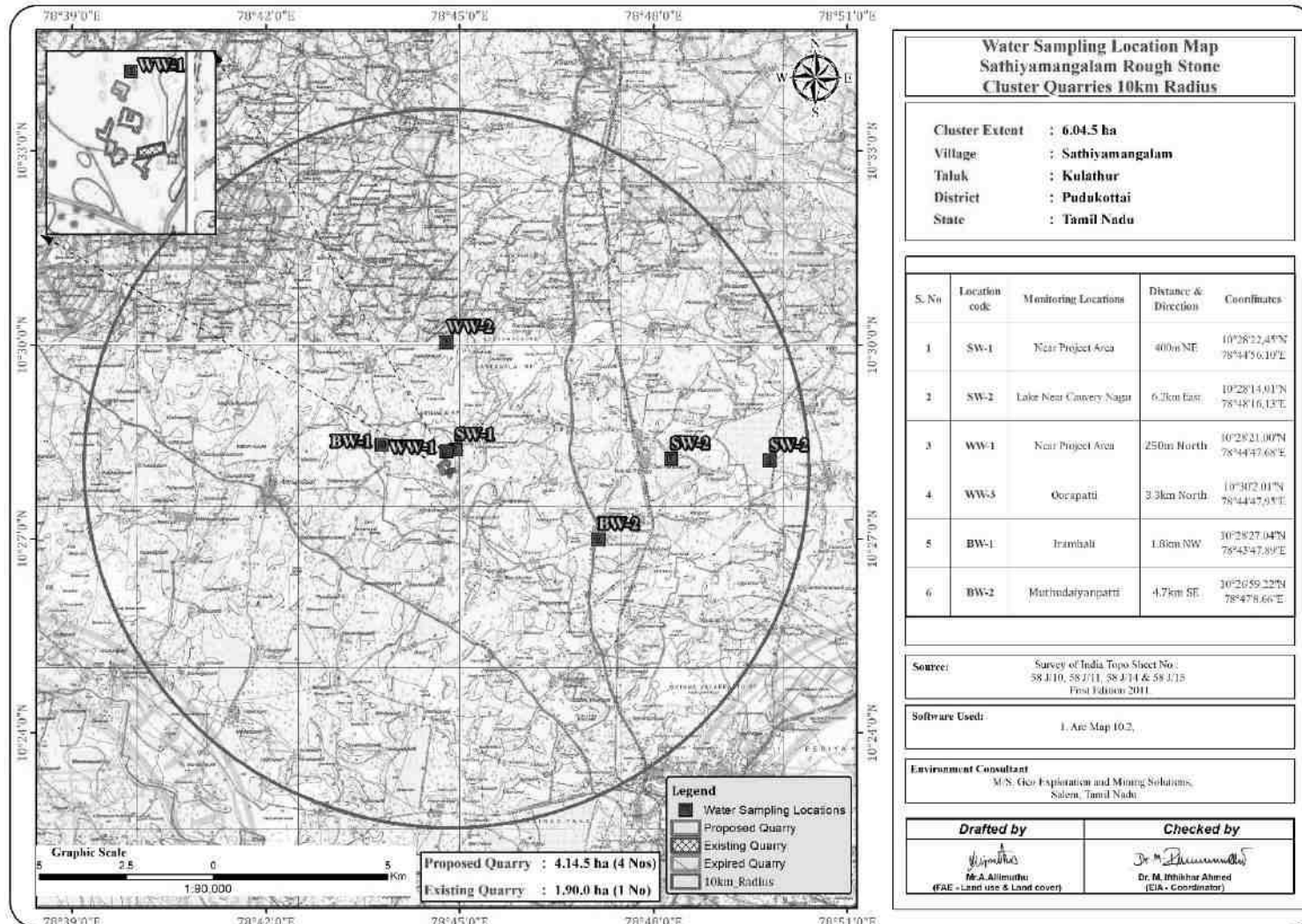
TABLE 3.9: GROUND WATER SAMPLING RESULTS

S.No	Parameters	Units	RESULTS				Standards as Per IS 10500: 2012	
			WW1	WW2	BW1	BW2	Acceptable limit	Permissible limit
1	Color	Hazen	< 5	< 5	< 10	< 5	5	5
2	Odour	-	Agreeable				Agreeable	Agreeable
3	Taste	-	Agreeable				Agreeable	Agreeable
4	pH@ 25°C	-	7.64	7.38	7.42	7.32	6.5-8.5	6.5-8.5
5	Electrical Conductivity @ 25°C	µs/cm	1018	896	890	924	Not specified	Not specified
6	Turbidity	NTU	2.8	< 0.5	< 0.5	< 0.5	1	1
7	TDS	mg /l	610	537	534	552	500	500
8	Total Hardness	mg/l	238	180	174	190	200	200
9	Calcium as Ca	mg/l	76	55	54	42	75	75
10	Magnesium as Mg	mg/l	11.7	10.3	9.5	20.6	30	30
11	Total Alkalinity	mg/l	246	146	168	170	200	200
12	Chloride as Cl-	mg/l	183	167	162	164	250	250
13	Sulphate as SO4-	mg/l	82	30	38	48	200	200
14	Iron as Fe	mg/l	0.02	0.15	0.41	0.38	0.3	0.3
15	Free Residual Cl	mg/l	BDL(DL:0.01)	BDL(DL:0.1)	BDL(DL:0.1)	BDL (DL:0.1)	0.2	0.2
16	Fluoride as F	mg/l	BDL(DL:0.02)	0.36	0.481	0.46	1.0	1.0
17	Nitrates as NO3	mg/l	38	25.2	20.4	15.6	45	45
18	Copper as Cu	mg/l	BDL (DL:0.01)				0.05	0.05
19	Manganese as Mn	mg/l	BDL (DL:0.02)				0.1	0.1
20	Mercury as Hg	mg/l	BDL (DL:0.0005)				0.001	0.001
21	Cadmium as Cd	mg/l	BDL (DL:0.001)				0.003	0.003
22	Selenium as Se	mg/l	BDL (DL:0.005)				0.01	0.01
23	Aluminium as Al	mg/l	BDL (DL:0.005)				0.03	0.03
24	Lead as Pb	mg/l	BDL (DL:0.005)				0.01	0.01
25	Zinc as Zn	mg/l	BDL(DL : 0.05)				5	5
26	Total Chromium	mg/l	BDL(DL : 0.02)				0.05	0.05
27	Boron as B	mg/l	BDL(DL : 0.05)				0.5	0.5
28	Mineral Oil	mg/l	BDL(DL : 0.01)				0.5	0.5
29	Phenolic Compounds	mg/l	BDL (DL:0.0005)				0.001	0.001
30	Anionic Detergents	mg/l	BDL (DL:0.01)				0.2	0.2
31	Cyanide as CN	mg/l	BDL (DL:0.01 l)				0.05	0.05
32	Barium as Ba	mg/l	BDL(DL:0.05)					
33	Ammonia	mg/l	BDL (DL:0.01)					
34	Sulphide as H2S	mg/l	BDL (DL:0.01)					
35	Molybdenum	mg/l	BDL (DL:0.02)					
36	Total Arsenic	mg/l	BDL (DL:0.005)					
37	Total Suspended Solids	Mg/l	BDL(DL:1.0)	10	12	BDL (DL:1.0)		
38	Total Coliform	MPN/ 100ml	120	140	150	110	Shall not be detectable in any100 ml	Shall not be detectable in any100 ml
39	E-Coli		< 1.8	< 1.8	< 1.8	< 1.8		

* IS: 10500:2012-Drinking Water Standards; # within the permissible limit as per the WHO Standard. The water can be used for drinking purpose in the absence of alternate sources. Note: SW- Surface water, GW – Ground water

TABLE 3.10: SURFACE WATER SAMPLING RESULTS

Sl. No.	Parameter	Unit	RESULT		CPCB Designated Best Use
			SW1	SW2	
1	Color	Hazen	5	5	300
2	Odour	-	Agreeable	Agreeable	Not specified
3	Taste	-	Agreeable	Agreeable	Not specified
4	pH@ 25°C	-	7.39	7.42	6.5 – 8.5
5	Electrical Conductivity @ 25°C	µs/cm	896	852 µmhos/cm	
6	Turbidity	NTU	1.1	Less than 0.5	Not specified
7	Total Dissolved Solids	mg /l	538	512	1500
8	Total Hardness as $CaCO_3$	mg/l	156	176	Not specified
9	Calcium as Ca	mg/l	40	54	Not specified
10	Magnesium as Mg	mg/l	13.6	10	Not specified
11	Total Alkalinity as $CaCO_3$	mg/l	172	160	Not specified
12	Chloride as Cl^-	mg/l	146	178	600
13	Sulphate as SO_4^-	mg/l	40	36	400
14	Iron as Fe	mg/l	0.50	0.30	50
15	Free Residual Chlorine	mg/l	BDL (DL:0.1)	BDL (DL:0.1)	400
16	Fluoride as F	mg/l	0.58	0.60	1.5
17	Nitrates as NO_3	mg/l	15.4	22.6	50
18	Copper as Cu	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	1.5
19	Manganese as Mn	mg/l	BDL (DL:0.02)	BDL (DL:0.02)	Not specified
20	Mercury as Hg	mg/l	BDL (DL:0.0005)	BDL (DL:0.0005)	Not specified
21	Cadmium as Cd	mg/l	BDL (DL:0.001)	BDL (DL:0.001)	0.01
22	Selenium as Se	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	Not specified
23	Aluminium as Al	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	Not specified
24	Lead as Pb	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	0.1
25	Zinc as Zn	mg/l	BDL(DL : 0.05)	BDL(DL : 0.05)	15
26	Total Chromium	mg/l	BDL(DL : 0.02)	BDL(DL : 0.02)	0.05
27	Boron as B	mg/l	BDL(DL : 0.05)	BDL(DL : 0.05)	Not specified
28	Mineral Oil	mg/l	BDL(DL : 0.01)	BDL(DL : 0.01)	Not specified
29	Phenolic Compounds as C_6H_5OH	mg/l	BDL (DL:0.0005)	BDL (DL:0.0005)	0.005
30	Anionic Detergents as MBAS	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	Not specified
31	Cyanide as CN	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	0.05
32	Biological Oxygen Demand, 3 days @ 27°C	mg/l	BDL(DL:2.0)	BDL(DL:2.0)	3
33	Chemical Oxygen Demand	mg/l	14	12	Not specified
34	Dissolved Oxygen	mg/l	5.2	5.4	4
35	Barium as Ba	mg/l	BDL(DL:0.05)	BDL(DL:0.05)	
36	Ammonia (as Total Ammonia-N)	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	
37	Sulphide as H_2S	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	
38	Molybdenum as Mo	mg/l	BDL (DL:0.02)	BDL (DL:0.02)	
39	Total Arsenic as As	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	
40	Total Suspended Solids	mg/l	11	BDL (DL:1.0)	
41	Total Coliform	MPN/ 100ml	1600	170	
42	E-Coli		110	< 1.8	

3.2.4   Interpretation& Conclusion

Surface Water

Ph:

The pH varied from 7.39 to 7.42 while turbidity found within the standards (Optimal pH range for sustainable aquatic life is 6.5 to 8.5 pH).

Total Dissolved Solids:

Total Dissolved Solids varied from 512 to 538 mg/l, the TDS mainly composed of carbonates, bicarbonates, Chlorides, phosphates and nitrates of calcium, magnesium, sodium and other organic matter.

Other parameters:

Chloride content is 146 to 178 mg/l. Nitrates varied from 15.4 to 22.6 mg/l, while sulphates varied from 36 to 40 mg/l.

Ground Water

The pH of the water samples collected ranged from 7.32 to 7.64 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. On Turbidity, the water samples meet the requirement. The Total Dissolved Solids were found in the range of 534 - 610 mg/l in all samples. The Total hardness varied between 174 – 238 mg/l for all samples.

On Microbiological parameters, the water samples from all the locations meet the requirement. The parameters thus analysed were compared with IS 10500:2012 and are well within the prescribed limits.

3.2.5   Hydrology and Hydrogeological studies

The district is underlain by hard rock formation fissured and fractured crystalline rocks constitute the important aquifer systems in the district. Geophysical prospecting was carried out in that area by SSRMP-80 Instrument by qualified Geo physicist with the help of IGIS software and it was inferred that the low resistance encountered at the depth between **65-70m**. The maximum depth proposed out of proposed projects is **30m bgl**. Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area. There is no necessity of stream, channel diversion due to these proposed projects.

During the rainy season there is a possibility of collection of seepage water from the subsurface levels which will be collected and stored in the mine sump pits and will be used for dust suppression and greenbelt development and during the end of the life of the mine this collected water will act as a temporary reservoir.

TABLE 3.11: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

LABEL	LONGITUDE	LATITUDE	Mar-22	Apr-22	May-22	Average
OW-1	78° 44' 47.73"E	10° 28' 21.01"N	11.5	11.9	12.5	11.97
OW_2	78° 44' 33.52"E	10° 27' 58.75"N	11.8	12.2	12.8	12.27
OW_3	78° 44' 22.67"E	10° 27' 51.16"N	10.8	11.2	11.8	11.27
OW_4	78° 44' 37.99"E	10° 27' 45.71"N	11.4	11.8	12.4	11.87
OW_5	78° 44' 43.08"E	10° 27' 32.70"N	11	11.4	12	11.47
OW_6	78° 45' 12.19"E	10° 27' 34.79"N	11.5	11.9	12.5	11.97
OW_7	78° 45' 16.74"E	10° 27' 37.42"N	12.2	12.6	13.2	12.67
OW-8	78° 45' 09.21"E	10° 28' 14.79"N	11.6	12	12.6	12.07
OW_9	78° 44' 53.87"E	10° 28' 25.68"N	10.7	11.1	11.7	11.17
OW_10	78° 44' 49.22"E	10° 28' 24.31"N	12.5	12.9	13.5	12.97
OW_11	78° 44' 43.62"E	10° 28' 25.15"N	12.2	12.6	13.2	12.67
OW_12	78° 44' 36.04"E	10° 28' 32.84"N	12.6	13	13.6	13.07
OW_13	78° 44' 51.66"E	10° 28' 46.19"N	11.6	12	12.6	12.07
OW_14	78° 45' 07.52"E	10° 28' 38.95"N	11.4	11.8	12.4	11.87
OW_15	78° 45' 14.99"E	10° 28' 28.88"N	10.8	11.2	11.8	11.27

Source: Onsite monitoring data

TABLE 3.12: PRE-MONSOON WATER LEVEL OF BOREWELLS 1 KM RADIUS

LABEL	LONGITUDE	LATITUDE	Mar-21	Apr-21	May-21	Average
BW_1	78° 45' 03.38"E	10° 28' 02.80"N	70.9	71.5	72.1	71.5
BW_2	78° 44' 57.00"E	10° 27' 43.89"N	71.2	71.8	72.4	71.8
BW_3	78° 44' 57.97"E	10° 27' 27.95"N	70.3	70.9	71.5	70.9
BW-4	78° 44' 31.11"E	10° 27' 33.16"N	67.2	67.8	68.4	67.8
BW-5	78° 44' 20.75"E	10° 27' 53.00"N	71.4	72	72.6	72
BW_6	78° 44' 35.21"E	10° 28' 06.05"N	70.6	71.2	71.8	71.2
BW_7	78° 44' 49.63"E	10° 28' 30.98"N	70.3	70.9	71.5	70.9
BW_8	78° 44' 38.51"E	10° 28' 40.86"N	70.2	70.8	71.4	70.8
BW_9	78° 45' 12.04"E	10° 28' 27.95"N	70	70.6	71.2	70.6
BW_10	78° 45' 24.13"E	10° 28' 15.51"N	71.5	72.1	72.7	72.1

Source: Onsite monitoring data

FIGURE 3.6: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE
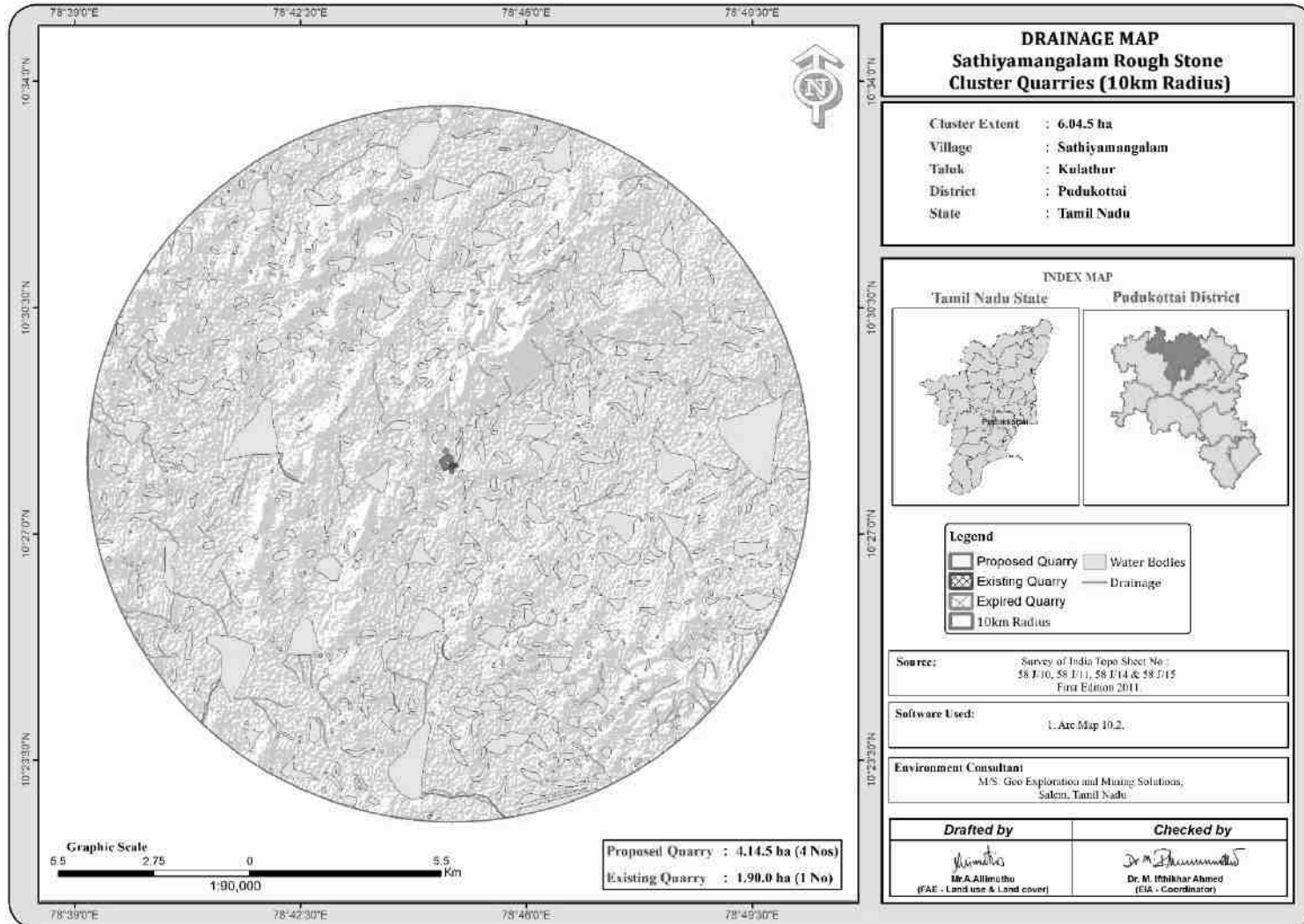
FIGURE 3.7: GROUND WATER PROSPECT MAP
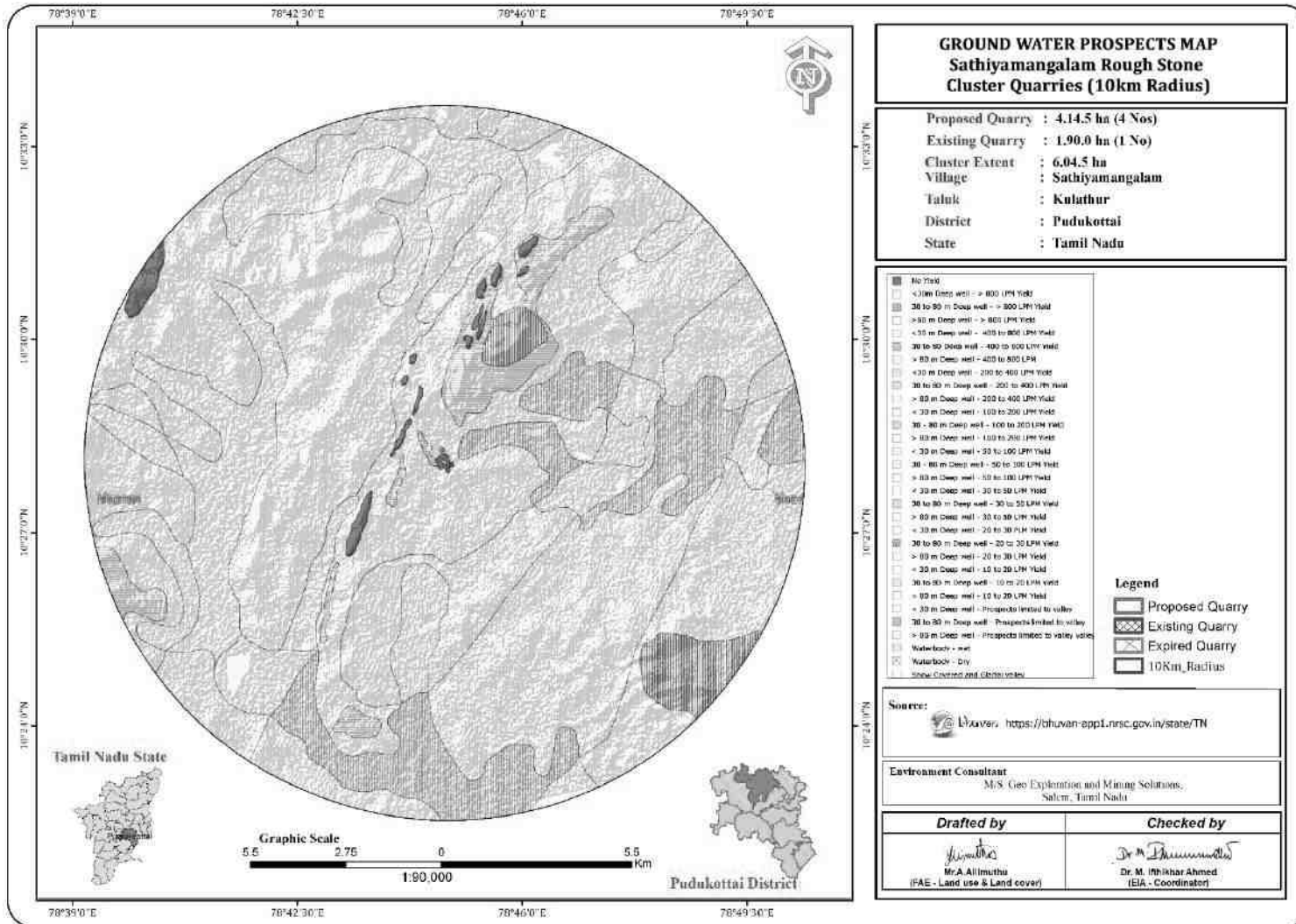
Source : Bhuvan

TABLE 3.13: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

LABEL	LONGITUDE	LATITUDE	Mar-22	Apr-22	May-22	Average
OW-1	78° 44' 47.73"E	10° 28' 21.01"N	11.5	11.9	12.5	11.97
OW_2	78° 44' 33.52"E	10° 27' 58.75"N	11.8	12.2	12.8	12.27
OW_3	78° 44' 22.67"E	10° 27' 51.16"N	10.8	11.2	11.8	11.27
OW_4	78° 44' 37.99"E	10° 27' 45.71"N	11.4	11.8	12.4	11.87
OW_5	78° 44' 43.08"E	10° 27' 32.70"N	11	11.4	12	11.47
OW_6	78° 45' 12.19"E	10° 27' 34.79"N	11.5	11.9	12.5	11.97
OW_7	78° 45' 16.74"E	10° 27' 37.42"N	12.2	12.6	13.2	12.67
OW-8	78° 45' 09.21"E	10° 28' 14.79"N	11.6	12	12.6	12.07
OW_9	78° 44' 53.87"E	10° 28' 25.68"N	10.7	11.1	11.7	11.17
OW_10	78° 44' 49.22"E	10° 28' 24.31"N	12.5	12.9	13.5	12.97
OW_11	78° 44' 43.62"E	10° 28' 25.15"N	12.2	12.6	13.2	12.67
OW_12	78° 44' 36.04"E	10° 28' 32.84"N	12.6	13	13.6	13.07
OW_13	78° 44' 51.66"E	10° 28' 46.19"N	11.6	12	12.6	12.07
OW_14	78° 45' 07.52"E	10° 28' 38.95"N	11.4	11.8	12.4	11.87
OW_15	78° 45' 14.99"E	10° 28' 28.88"N	10.8	11.2	11.8	11.27

Source: Field Monitoring Data

FIGURE 3.14: BAR CHART OF PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM

PRE MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

	OW-1	OW_2	OW_3	OW_4	OW_5	OW_6	OW_7	OW-8	OW_9	OW_10	OW_11	OW_12	OW_13	OW_14	OW_15
MARCH	11.5	11.8	10.8	11.4	11	11.5	12.2	11.6	10.7	12.5	12.2	12.6	11.6	11.4	10.8
APRIL	11.9	12.2	11.2	11.8	11.4	11.9	12.6	12	11.1	12.9	12.6	13	12	11.8	11.2
MAY	12.5	12.8	11.8	12.4	12	12.5	13.2	12.6	11.7	13.5	13.2	13.6	12.6	12.4	11.8

■MARCH ■APRIL ■MAY
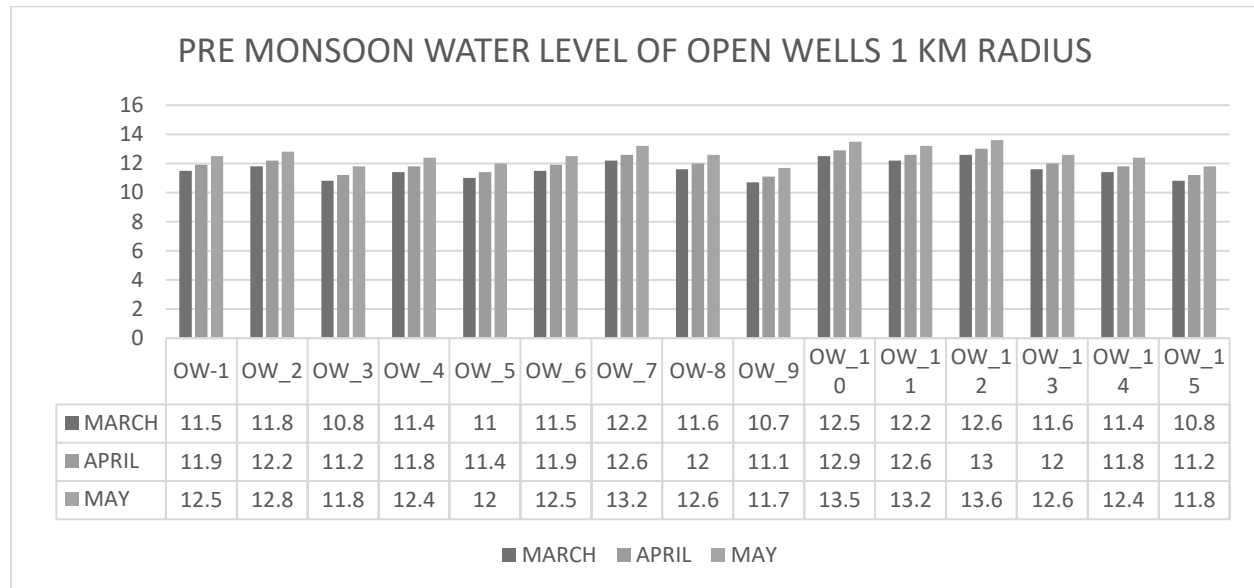
FIGURE 3.11: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – MAR 2022
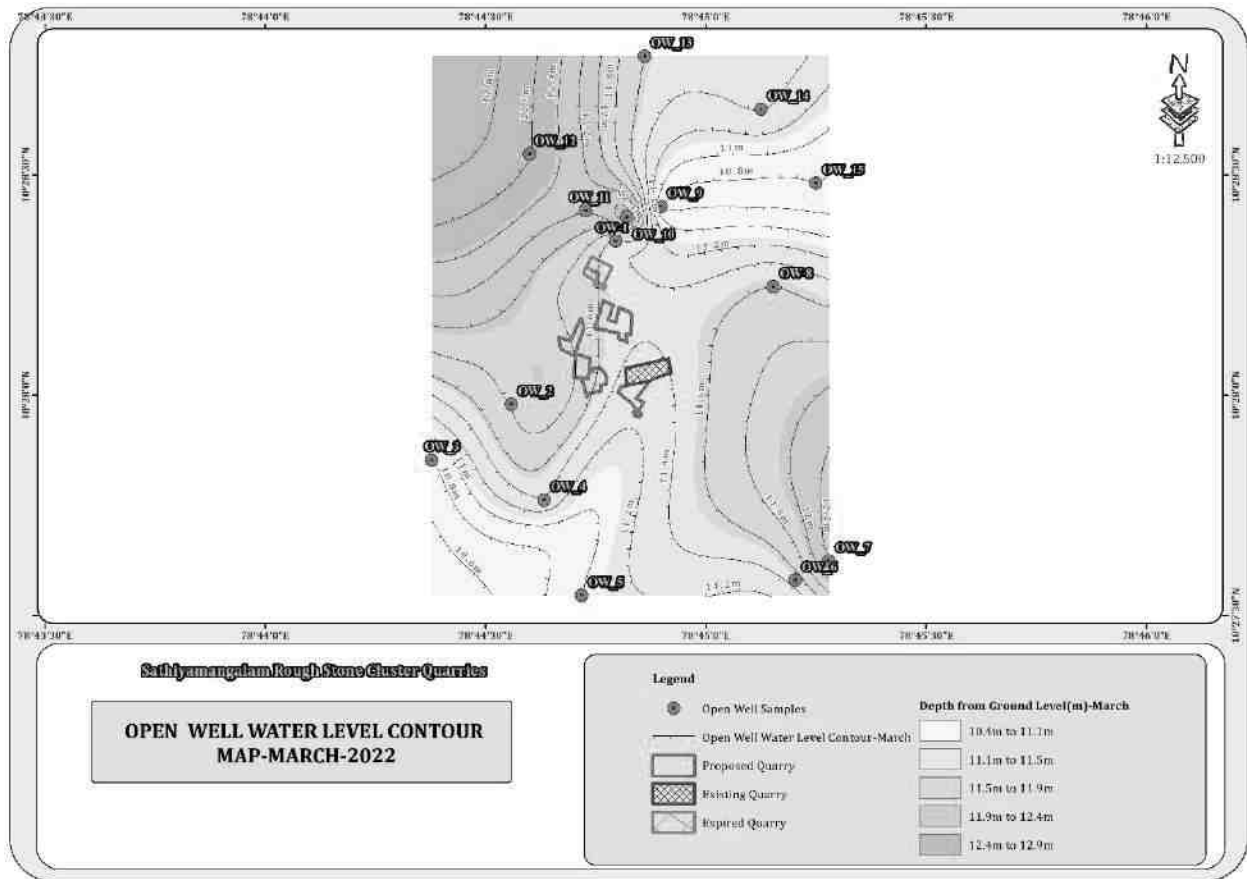
FIGURE 3.12: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – APR 2022
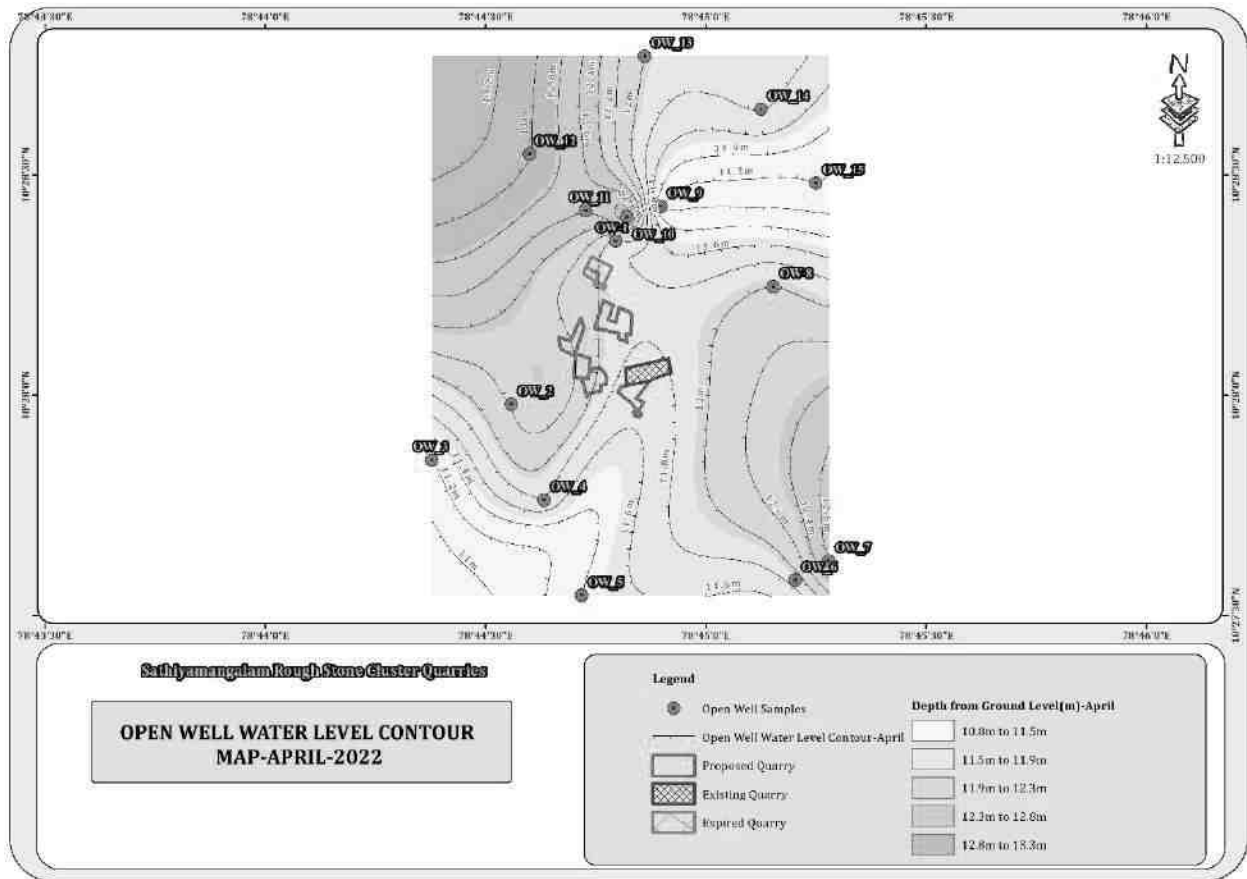
FIGURE 3.13: PRE-MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS – MAY 2022
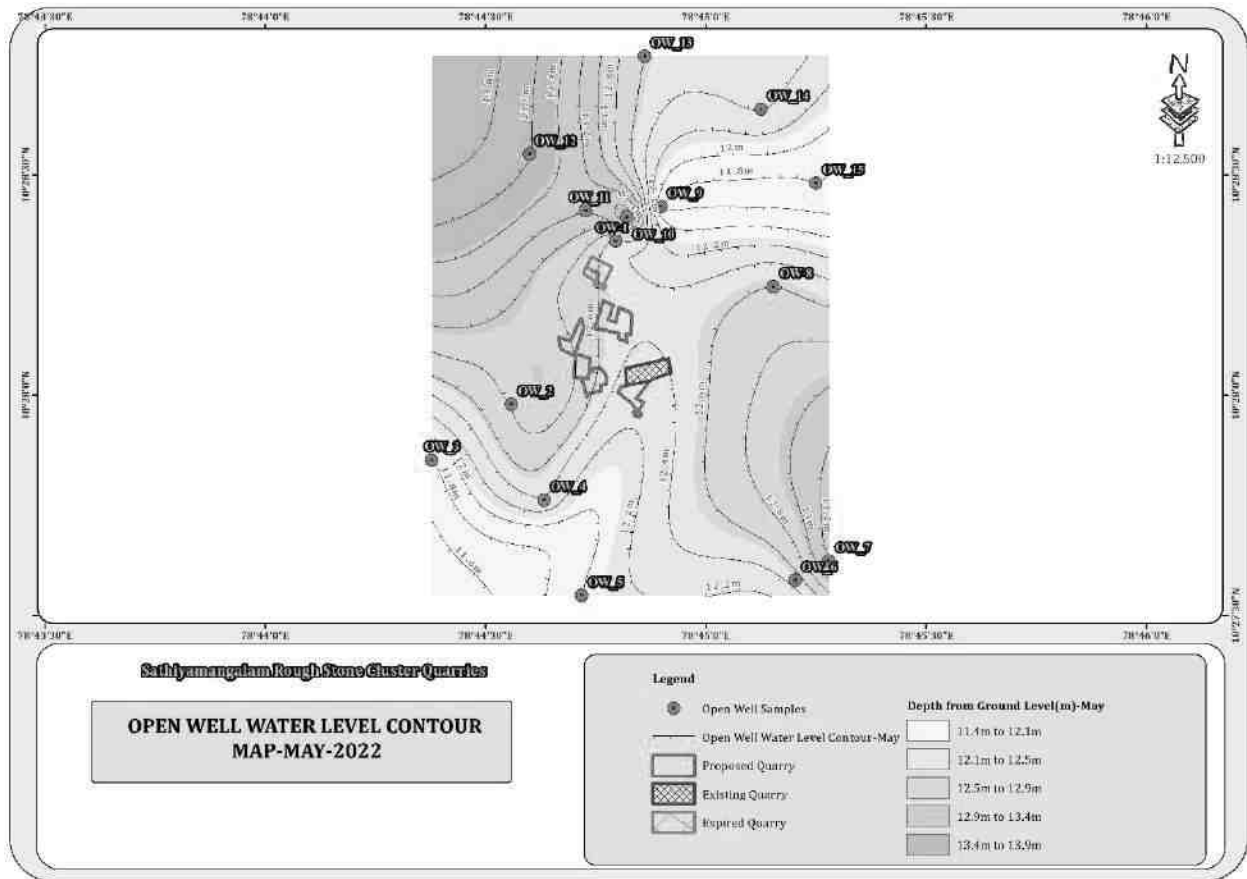
TABLE 3.14: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS

LABEL	LONGITUDE	LATITUDE	Mar-21	Apr-21	May-21	Average
BW_1	78° 45' 03.38"E	10° 28' 02.80"N	70.9	71.5	72.1	71.5
BW_2	78° 44' 57.00"E	10° 27' 43.89"N	71.2	71.8	72.4	71.8
BW_3	78° 44' 57.97"E	10° 27' 27.95"N	70.3	70.9	71.5	70.9
BW-4	78° 44' 31.11"E	10° 27' 33.16"N	67.2	67.8	68.4	67.8
BW-5	78° 44' 20.75"E	10° 27' 53.00"N	71.4	72	72.6	72
BW_6	78° 44' 35.21"E	10° 28' 06.05"N	70.6	71.2	71.8	71.2
BW_7	78° 44' 49.63"E	10° 28' 30.98"N	70.3	70.9	71.5	70.9
BW_8	78° 44' 38.51"E	10° 28' 40.86"N	70.2	70.8	71.4	70.8
BW_9	78° 45' 12.04"E	10° 28' 27.95"N	70	70.6	71.2	70.6
BW_10	78° 45' 24.13"E	10° 28' 15.51"N	71.5	72.1	72.7	72.1

Source: Field Monitoring Data

FIGURE 3.14: BAR CHART OF PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM

PRE MONSOON WATER LEVEL OF BOREWELLS 1 KM RADIUS

	BW_1	BW_2	BW_3	BW-4	BW-5	BW_6	BW_7	BW_8	BW_9	BW_10
MARCH	70.9	71.2	70.3	67.2	71.4	70.6	70.3	70.2	70	71.5
APRIL	71.5	71.8	70.9	67.8	72	71.2	70.9	70.8	70.6	72.1
MAY	72.1	72.4	71.5	68.4	72.6	71.8	71.5	71.4	71.2	72.7
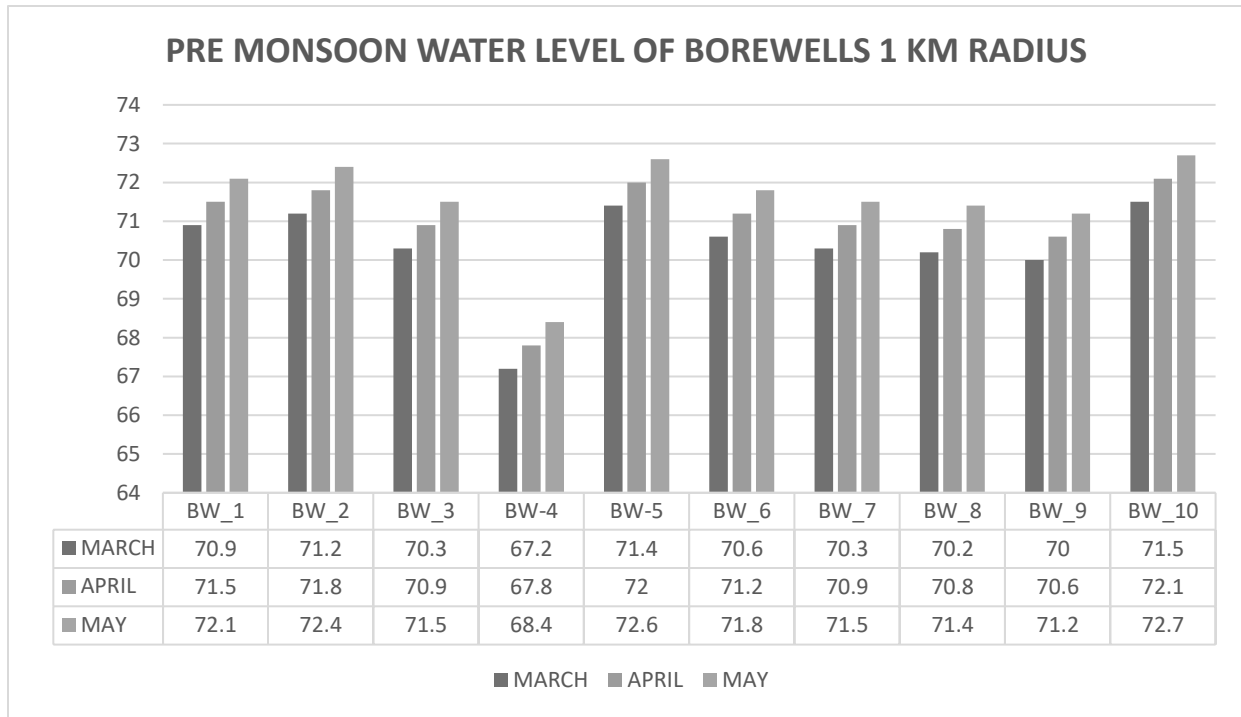
Source: Table 3.18

FIGURE 3.15: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS – MAR 2022
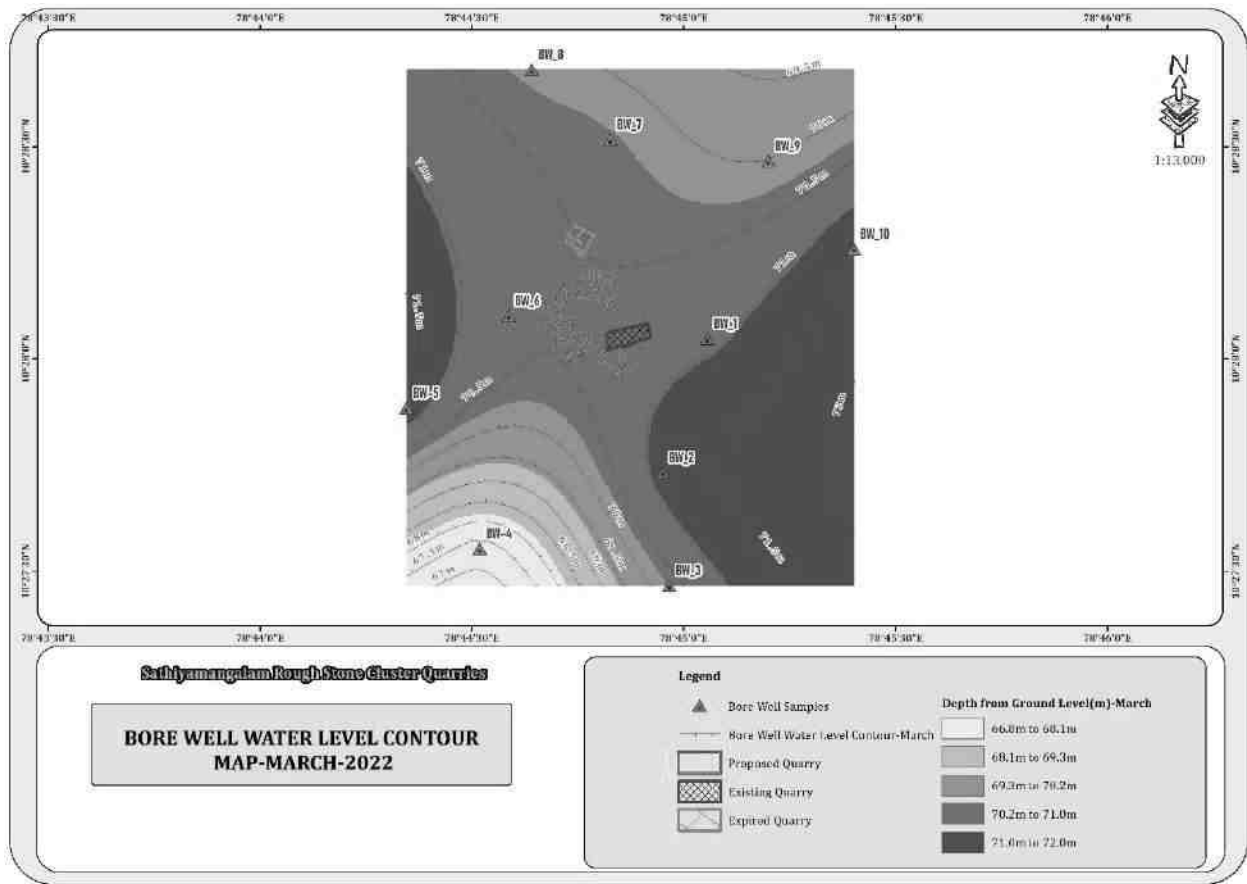
FIGURE 3.16: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS – APR 2022
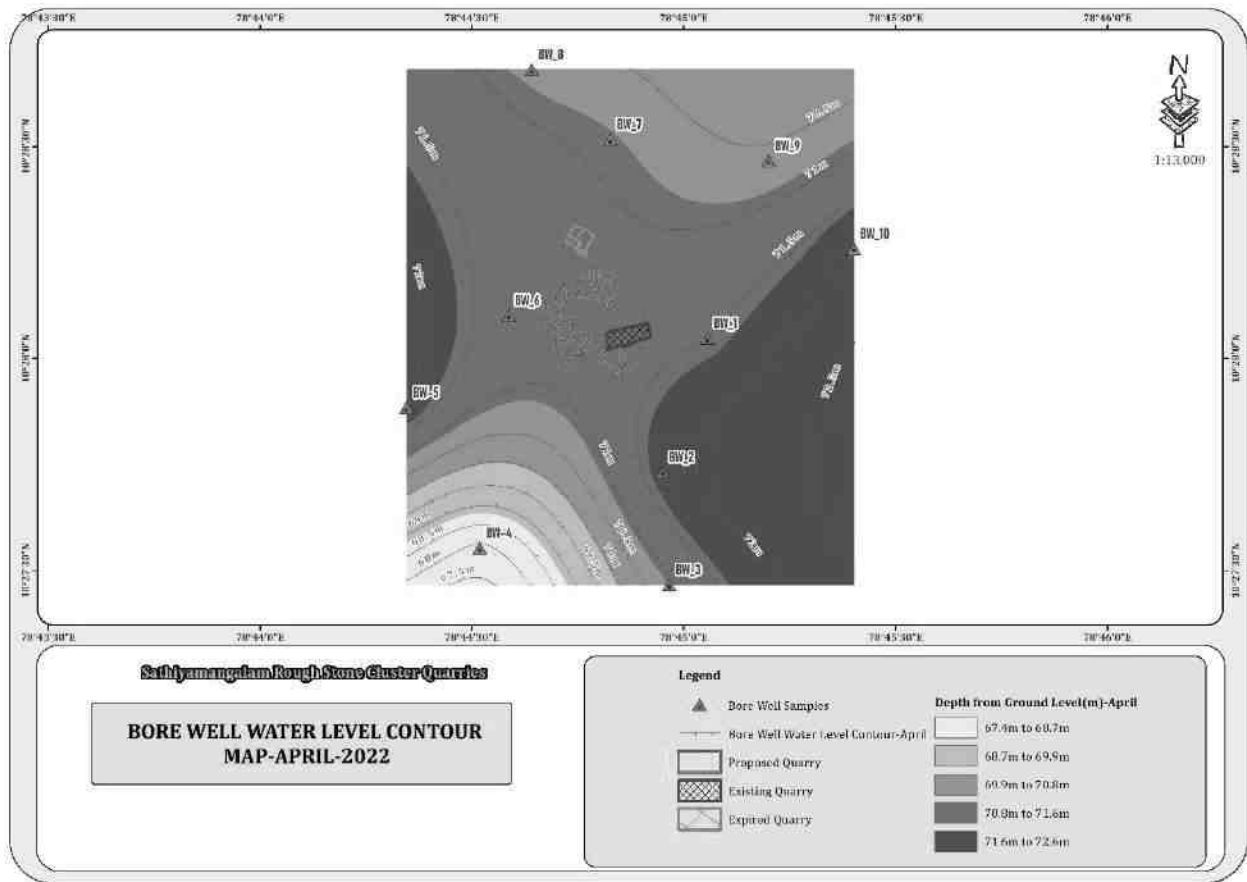
FIGURE 3.17: PRE-MONSOON WATER LEVEL OF BORE WELLS 1 KM RADIUS – MAY 2022
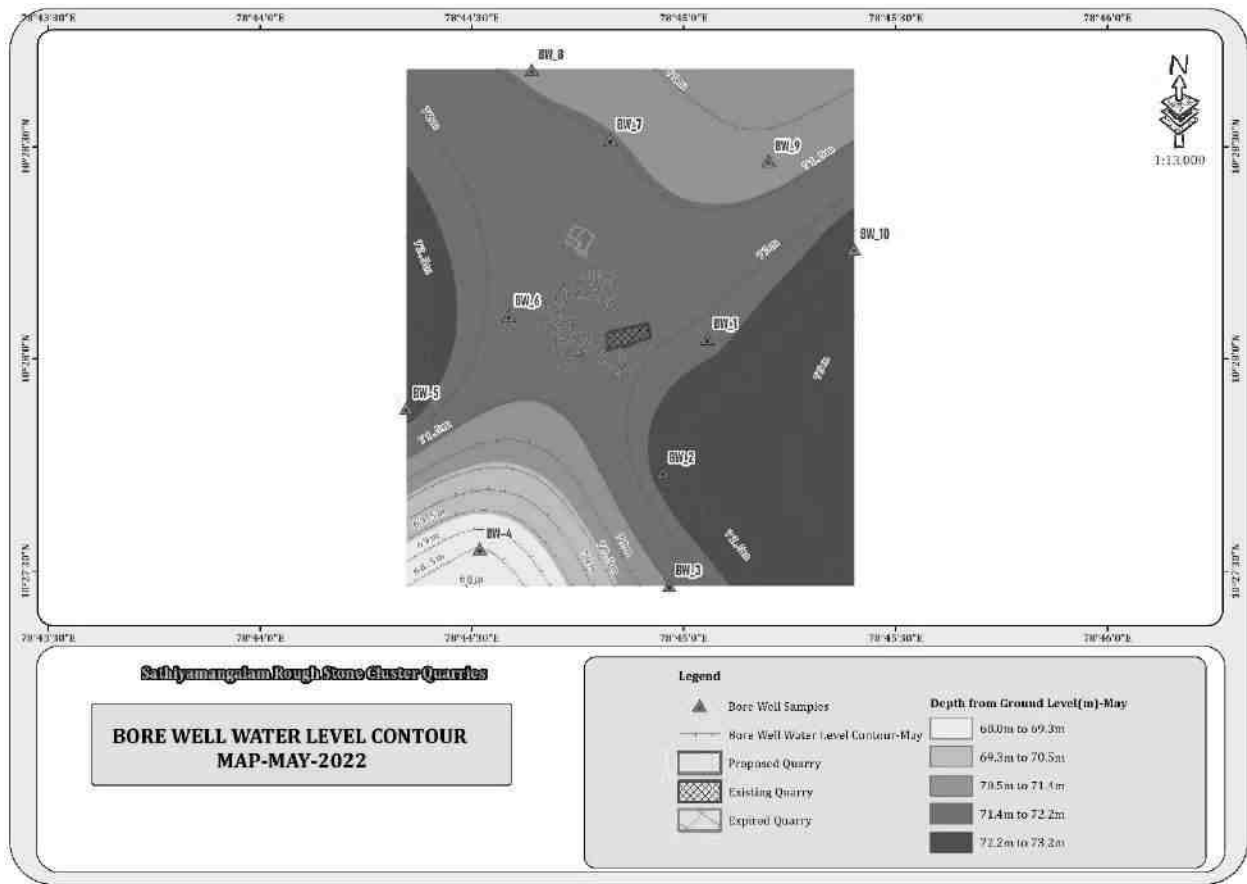
3.2.5.1 Methodology and Data Acquisition

Electric Resistivity Method is well established for delineating lateral as well vertical discontinuities in the resistive structure of the Earth's subsurface. The present study makes use of vertical electric sounding (VES) to delineate the Vertical Resistivity structure at depth. Schlumberger electrode set up was employed for making sounding measurements. Since it is least influenced by lateral in homogeneities and is capable of providing higher depth of investigation. This is four electrodes collinear set up where in the outer electrodes send current into the ground and the inner electrodes measure the potential difference.

The present study utilizes maximum current electrode separation AB/2. The data from this survey are commonly arranged and contoured in the farm of Pseudo-section that gives an approximate of the subsurface resistivity. This technique is used for the inversion of Schlumberger VES data to predict the layer parameter namely layer resistivity and Geo electric layer thickness. The main goal of the present study is to search the vertical in homogeneities that is consistent with the measured data.

For a Schlumberger among the Apparent resistivity can be calculated as follows

$$\rho_a = \frac{G\Delta V}{I}$$

ΔV = potential difference between receiving electrodes

G   = Geometric Factor.

Rocks show wide variation in resistivity ranging from 10-8 more than 10+14 ohmmeter. On a broad classification, one can group the rocks falling in the range of 10-8 to 1 ohmmeter as good conductors. 1 to 106 ohmmeter as intermediate conductors and 106 to 1012 ohmmeter as more as poor conductor. The resistivity of rocks and subsurface lithology, which is mostly dependent on its porosity and the pore fluid resistivity is defined by Archie's Law,

$$\rho_r = F\rho_w = a\, Ø^m \rho_w$$

ρr = Resistivity of Rocks

ρw = Resistivity of water in pores of rock

F   = Formation Factor

Ø   = Fractional pore volume

A   = Constants with values ranging from 0.5 to 2.5

3.2.5.2 Survey Layout

The layout for a resistivity survey depends on the choice of the current and potential electrode arrangement, which is called electrode array. Here the present study is considered with Schlumberger array. In which the distance may be used for current electrode separation while potential electrode separation is kept on third to one fifth of the same. One interesting aspect in VES is the principle of reciprocity, which permits interchange of the potential and current electrode without any effect on the measured apparent resistivity.

The field equipment deployed for the study is in a deep resistivity meter with a model of SSR – MP – AT. This Signal stacking Resistivity meter is a high-quality data acquisition system incorporating several innovation features for Earth resistivity. In the presence of random earth Noises the signal to nose ration can be enhanced by $\sqrt{N}$ where N is the number of stacked readings. This SSR meter in which running averages of measurements [1, (1+2)/2, (1+2+3)/3 … (1+2...+16/16)] up to the chosen stacks are displayed and the final average is stored automatically, in memory utilizing the principles of stacking to achieve the benefit of high signals to noise ratio. Based on these above significations the signal stacking resistivity meter was used for (VES) Vertical Electric Resistivity Sounding.

RESISTIVITY SURVEY PROFILE
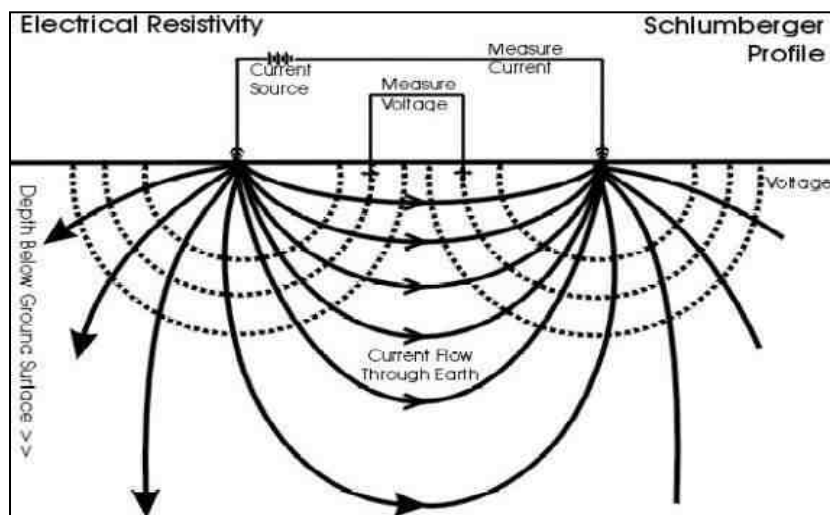
Measurements of ground Resistivity is essentially done by sending a current through two electrodes called current electrodes (C_1 & C_2) and measuring the resulting potential by two other electrodes called potential electrode (P_1 & P_2). The amount of current required to be sent into the ground depends on the contact resistance at the current electrode, the ground resistivity and the depth of interest.

TABLE 3.15: GPS CO-ORDINATES OF VES LOCATION

No of station	Co-ordinates	Vertical Electrical Sounding depth in (m)
Satation-1	10°28'11.55"N78°44'46.24"E	100m
Satation-2	10°28'10.65"N 78°44'49.10"E	100m
Satation-3	10°28'8.22"N 78°44'50.14"E	100m

Source: Field Data

3.2.5.3 Data Presentation

TABLE 3.16: VES RESULTS OF STATION – 1

			STATION-1		
S.No	Ab/2	Mn/2	K	R	Rho
1	2	1	4.71	16.21	76.30
2	4	1	23.55	5.86	138.00
3	6	1	54.95	2.93	160.45
4	8	1	98.91	1.92	189.91
5	10	1	155.45	1.40	217.63
6	10	5	23.55	10.20	240.21
7	15	5	62.80	4.30	270.04
8	20	5	117.75	2.55	300.26
9	30	5	274.75	1.22	335.20
10	40	5	494.55	0.73	365.97
11	50	5	777.15	0.51	396.35
12	60	5	1122.55	0.39	437.79
13	70	5	1530.75	0.31	474.53
14	80	5	2001.75	0.25	522.46
15	90	5	2535.55	0.22	557.82
16	100	5	3132.15	0.19	595.11

Source: Field Data

FIGURE 3.19: INVERSE SLOP METHOD GRAPHS OF STATION – 1
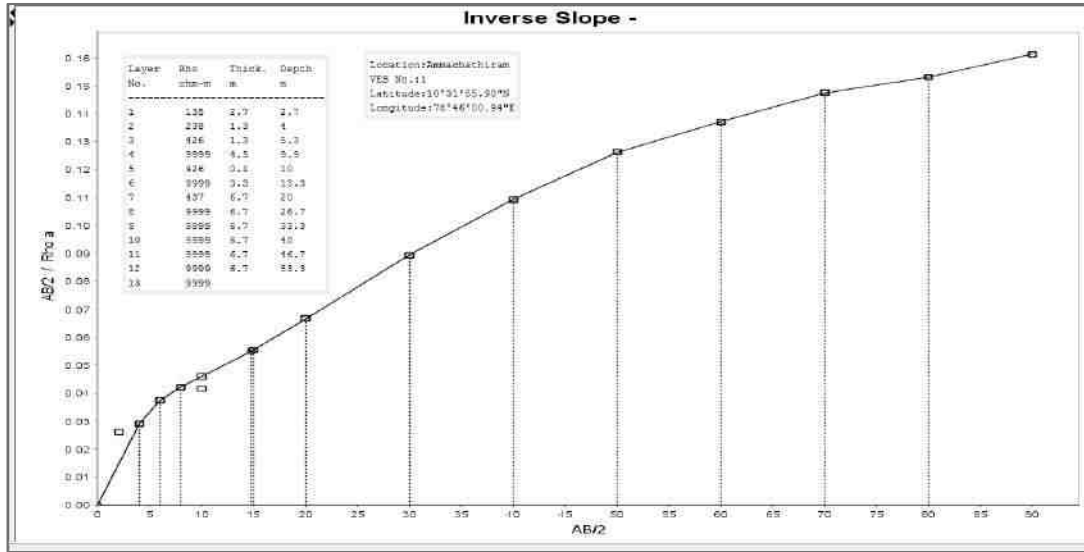
TABLE 3.17: VES RESULTS OF STATION – 2

STATION-2					
S.No	Ab/2	Mn/2	K	R	Rho
1	2	1	4.71	14.15	66.69
2	4	1	23.55	4.02	94.67
3	6	1	54.95	2.80	153.86
4	8	1	98.91	2.02	199.80
5	10	1	155.45	1.58	245.61
6	10	5	23.55	12.05	284.01
7	15	5	62.80	5.12	321.54
8	20	5	117.75	3.06	360.32
9	30	5	274.75	1.44	395.64
10	40	5	494.55	0.87	430.26
11	50	5	777.15	0.60	466.29
12	60	5	1122.55	0.46	505.15
13	70	5	1530.75	0.35	535.76
14	80	5	2001.75	0.28	560.49
15	90	5	2535.55	0.22	583.18
16	100	5	3132.15	0.20	626.43

Source: Field Data

FIGURE 3.20: INVERSE SLOP METHOD GRAPHS OF STATION – 2
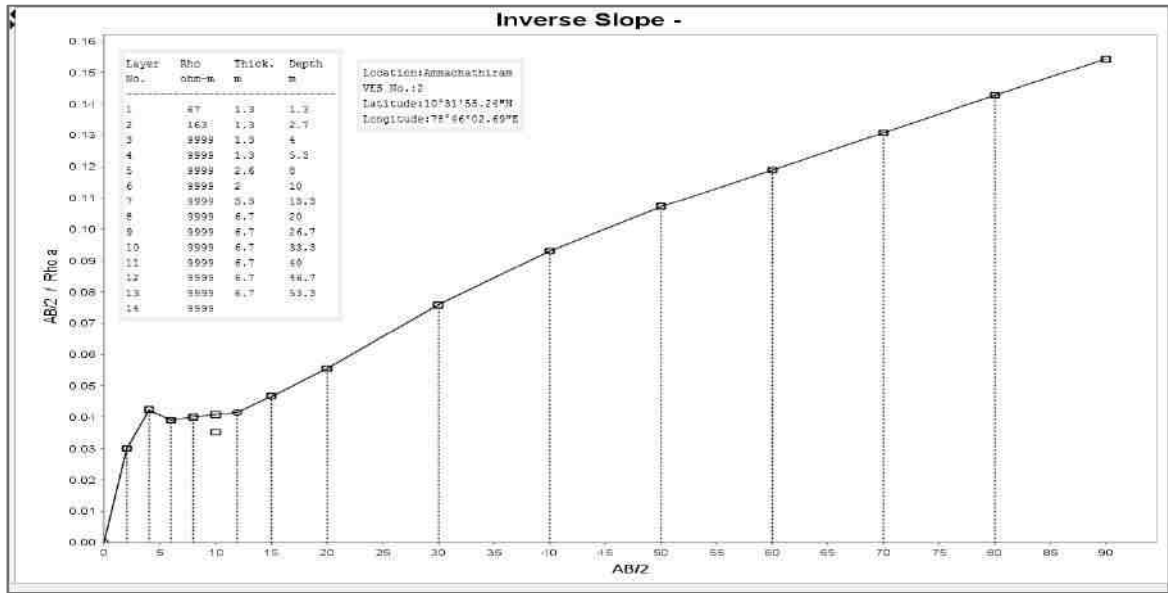
TABLE 3.18: VES RESULTS OF STATION – 3

STATION-3					
S.No	Ab/2	Mn/2	K	R	Rho
1	2	1	4.71	14.61	68.77
2	4	1	23.55	4.98	117.28
3	6	1	54.95	3.01	165.95
4	8	1	98.91	2.10	207.71
5	10	1	155.45	1.48	230.07
6	10	5	23.55	11.20	263.76
7	15	5	62.80	4.60	288.88
8	20	5	117.75	2.70	317.93
9	30	5	274.75	1.26	346.19
10	40	5	494.55	0.76	375.86
11	50	5	777.15	0.53	411.89
12	60	5	1122.55	0.41	449.02
13	70	5	1530.75	0.32	489.84
14	80	5	2001.75	0.27	520.46
15	90	5	2535.55	0.22	557.82
16	100	5	3132.15	0.18	563.79

Source: Field Data

FIGURE 3.21: INVERSE SLOP METHOD GRAPHS OF STATION – 3
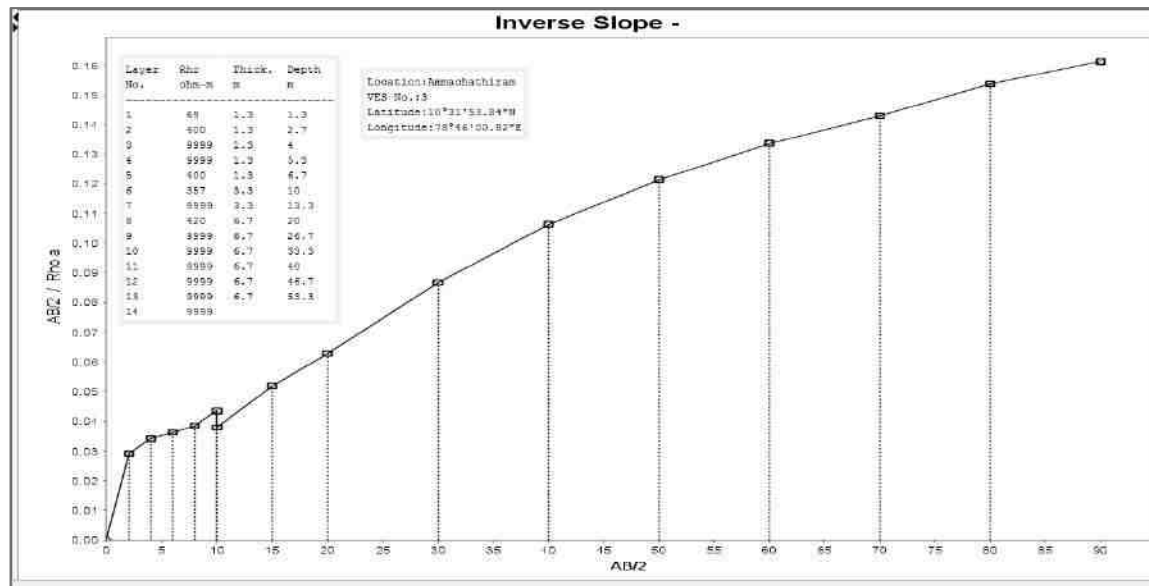
3.2.5.4 Geophysical Data Interpretation

The geophysical data's was obtained to study the lateral variations, vertical in homogeneities in the sub – surface with respect to the availability of groundwater. From the interpreted data, it has inferred that the area has moderate groundwater potential in the investigated area. This small quarrying operation will not have any significant impact on the natural water bodies.

3.3 AIR ENVIRONMENT

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

The baseline studies on air environment include identification of specific air pollution parameters and their existing levels in ambient air. The ambient air quality with respect to the study zone of 10 km radius around the cluster forms the baseline information. The sources of air pollution in the region are mostly due to vehicular traffic, dust arising from unpaved village road and domestic & agricultural activities. The prime objective of the baseline air quality study was to establish the existing ambient air quality of the study area. These will also be useful for assessing the conformity to standards of the ambient air quality during the operation of proposed project in cluster.

This section describes the identification of sampling locations, methodology adopted during the monitoring period and sampling frequency.

3.3.1   Meteorology & Climate

Meteorology is the key to understand the Air quality. The essential relationship between meteorological condition and atmospheric dispersion involves the wind in the broadest sense. Wind fluctuations over a very wide range of time, accomplish dispersion and strongly influence other processes associated with them.

A temporary meteorological station was installed at project site by covering cluster quarries. The station was installed at a height of 3 m above the ground level in such a way that there are no obstructions facilitating flow of wind, wind speed, wind direction, humidity and temperature are recorded on hourly basis.

Climate

➢ Pudukkottai are in the middle and the summers are that easy to define.

➢ The best time to visit are January, February, October, November, December.

➢ The month with the highest relative humidity is November (78.25 %). The month with the lowest relative humidity is July (55.68 %).

➢ The month with the highest number of rainy days is October (19.20 days). The month with the lowest number of rainy days is February (3.23 days).

➢ Pudukkottai has a tropical climate. The summers here have a good deal of rainfall, while the winters have very little. This location is classified as Aw by Köppen and Geiger. The average temperature in Pudukkottai is 28.0 °C | 82.4 °F. Precipitation here is about 925 mm | 36.4 inch per year.

➢ The driest month is February, with 15 mm | 0.6 inches of rainfall. Most of the precipitation here falls in November, averaging 203 mm | 8.0 inches.

➢ The warmest month of the year is May, with an average temperature of 31.0 °C | 87.8 °F. January is the coldest month, with temperatures averaging 24.4 °C | 76.0 °F.

https://en.climate-data.org/asia/india/tamil-nadu/pudukkottai-24013/

Rainfall

TABLE 3.19: RAINFALL DATA

Actual Rainfall in mm					Normal Rainfall in mm
2017	2018	2019	2020	2021	
724.4	692.1	876.2	947.6	1188.7	985

Source: https://www.twadboard.tn.gov.in/content/pudukottai

TABLE 3.20: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Mar – 2022	Apr – 2022	May – 2022
1	Temperature (^{0}C)	Max	31.05	30.81	31.57
		Min	25.48	27.85	28.12
		Avg	28.265	29.33	29.845
2	Relative Humidity (%)	Avg	65.965	70.125	70.125
3	Wind Speed (m/s)	Max	4.97	3.62	6.68
		Min	1.82	1.51	1.81
		Avg	3.395	2.565	4.245
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		SE, E	SE, SSE	WSW, W

Source: On-site monitoring/sampling by Chennai Mettex Laboratories in association with GEMS

Correlation between Secondary and Primary Data

The meteorological data collected at the site is almost similar to that of secondary data collected from IMD Pudukkottai_Agro. A comparison of site data generated during the three months with that of IMD, Pudukkottai_Agro reveals the following:

- The average maximum and minimum temperatures of IMD, Pudukkottai_Agro showed a higher in respect of on-site data i.e., in Sathiyamangalam village.
- The relative humidity levels were lesser at site as compared to IMD, Pudukkottai_Agro.
- The wind speed and direction at site shows similar trend that of IMD, Pudukkottai_Agro.

Wind rose diagram of the study site is depicted in Figure. 3.8. Predominant downwind direction of the area during study season is South-West to North-East.

FIGURE 3.22: WINDROSE DIAGRAM
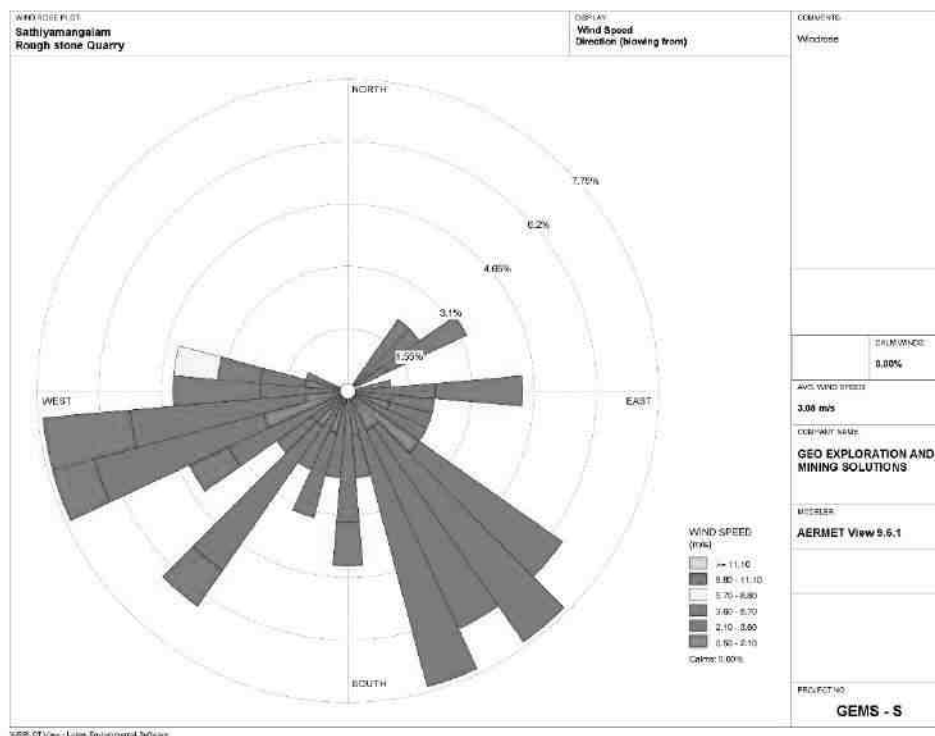
 Source: Wind Rose plot view, Lake Environmental Software

In the abstract of collected data wind rose were drawn on presented in figure No.3.21 during the monitoring period in the study area

- Predominant winds were from SW-NE.

- Wind velocity readings were recorded between 0.50 to 8.80 m/s

- Calm conditions prevail of about 0.00 % of the monitoring period

- Temperature readings ranging from 25.48 to 31.57 °C

- Relative humidity ranging from 65.965 to 70.125 %

- The monitoring was carried out continuously for three months

3.3.2   Methodology and Objective

　　　　The prime objective of the ambient air quality study is to assess the existing air quality of study area and its conformity to NAAQS. The observed sources of air pollution in the study area are industrial, traffic and domestic activities. The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality monitoring network considering the followings:

- Meteorological condition on synoptic scale;

- Topography of the study area;

- Representatives of regional background air quality for obtaining baseline status;

- Location of residential areas representing different activities;

- Accessibility and power availability; etc

3.3.3 Sampling and Analytical Techniques

TABLE 3.21: METHODOLOGY AND INSTRUMENT USED FOR AAQ ANALYSIS

Parameter	Method	Instrument
PM2.5	Gravimetric Method Beta attenuation Method	Fine Particulate Sampler Make – Thermo Environmental Instruments – TEI 121
PM10	Gravimetric Method Beta attenuation Method	Respirable Dust Sampler Make –Thermo Environmental Instruments – TEI 108
SO2	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NOx	IS-5182 Part II (Jacob & Hochheiser modified method)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by Chennai Mettex Laboratories & CPCB Notification

TABLE 3.22: NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl. No.	Pollutant	Time Weighted Average	Concentration in ambient air	
			Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
1	Sulphur Dioxide (μg/m3)	Annual Avg.* 24 hours**	50.0 80.0	20.0 80.0
2	Nitrogen Dioxide (μg/m3)	Annual Avg. 24 hours	40.0 80.0	30.0 80.0
3	Particulate matter (size less than 10μm) PM10 (μg/m3)	Annual Avg. 24 hours	60.0 100.0	60.0 100.0
4	Particulate matter (size less than 2.5 μm PM2.5 (μg/m3)	Annual Avg. 24 hours	40.0 60.0	40.0 60.0

Source: NAAQS CPCB Notification No. B-29016/20/90/PCI-I Dated: 18th Nov 2009
*Annual Arithmetic mean of minimum 104 measurements in a year taken twice a Week 24 hourly at uniform interval,
** 24 hourly / 8 hourly or 1 hourly monitored values as applicable shall be complied with 98 % of the time in a year. However, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

3.3.4 Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at eight (8) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period March to May, 2022. The baseline data of ambient air has been generated for PM$_{10}$, PM$_{2.5}$, Sulphur Dioxide (SO$_2$) & Nitrogen Dioxide (NO$_2$) Monitoring has been carried out as per the CPCB, MoEF guidelines and notifications.

It was ensured that the equipment was placed preferably at a height of at least 3 ± 0.5m above the ground level at each monitoring station, for negating the effects of wind-blown ground dust. The equipment was placed at open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results.

3.3.5 Ambient Air Quality Monitoring Stations

Eight (8) monitoring stations were set up in the study area as depicted in Figure 3.6.1 for assessment of the existing ambient air quality. Details of the sampling locations are as per given below.

TABLE 3.23: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Project area	North East	10°28'11.11"N 78°44'49.74"E
2	AAQ-2	Sathyamangalam	2.6km NE	10°28'45.31"N 78°46'09.41"E
3	AAQ-3	Cauvery nagar	5.3 km SE	10°28'04.63"N 78°47'46.48"E
4	AAQ-4	Muthudaiyanpatti	5 km SE	10°26'59.49"N 78°47'18.11"E
5	AAQ-5	Oorapatti	3.5 km North	10°30'08.61"N 78°44'51.39"E
6	AAQ-6	Keelakurichy	3.4 km NW	10°29'42.06"N 78°43'38.70"E
7	AAQ-7	Irambali	2 km NW	10°28'29.30"N 78°43'42.09"E
8	AAQ-8	Madiyanallur	2 km SW	10°26'59.30"N 78°44'31.46"E

Source: On-site monitoring/sampling by Chennai Mettex Laboratories in association with GEMS

FIGURE 3.23: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

TABLE 3.24: AMBIENT AIR QUALITY DATA LOCATION AAQ1

Period: March – May-2022   *Location: AAQ1- Core Zone*   Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
04.03.2022	5:30-5:30	125	52.3	28.6	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.03.2022	5:45-5:45	108	68.5	25.1	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2022	5:30-5:30	112	64.9	36.8	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.03.2022	5:45-5:45	124	52.0	27.5	9.2	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2022	5:30-5:30	105	65.1	32.2	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.03.2022	5:45-5:45	138	52.6	34.7	9.8	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2022	5:30-5:30	112	56.7	23.2	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.03.2022	5:45-5:45	104	67.2	38.4	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2022	5:30-5:30	122	54.4	23.3	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2022	5:45-5:45	106	62.6	34.5	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.04.2022	5:30-5:30	124	51.9	30.8	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.04.2022	5:45-5:45	118	59.4	22.4	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.04.2022	5:30-5:30	132	64.8	38.9	9.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.04.2022	5:45-5:45	104	56.2	26.7	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2022	5:30-5:30	122	68.5	29.2	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.04.2022	5:45-5:45	116	52.8	31.5	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.04.2022	5:30-5:30	127	66.7	28.1	9.8	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.04.2022	5:45-5:45	108	55.4	22.6	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2022	5:30-5:30	135	51.6	37.3	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.04.2022	5:45-5:45	111	62.2	26.8	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2022	5:30-5:30	125	58.8	34.1	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.05.2022	5:45-5:45	106	53.9	33.0	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2022	5:30-5:30	134	67.4	25.4	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.05.2022	5:45-5:45	118	59.6	28.8	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2022	5:30-5:30	105	51.1	22.5	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.05.2022	5:45-5:45	122	64.8	38.0	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2022	5:30-5:30	111	56.5	34.2	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.05.2022	5:45-5:45	105	62.3	29.4	9.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

TABLE 3.25: AMBIENT AIR QUALITY DATA LOCATION AAQ2

Period: March – May-2022   *Location: AAQ2- Sathyamangalam*   Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM$_{10}$	PM$_{2.5}$	SO$_2$	NO$_2$	NH$_3$	O$_3$	CO	Pb	Ni	As	C$_6$H$_6$	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m^3	µg/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
04.03.2022	5:30-5:30	125	53.1	22.6	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.03.2022	5:45-5:45	100	67.4	36.8	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2022	5:30-5:30	132	52.8	27.5	9.2	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.03.2022	5:45-5:45	118	64.6	32.9	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2022	5:30-5:30	104	56.2	29.7	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.03.2022	5:45-5:45	139	58.0	24.4	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2022	5:30-5:30	127	51.5	36.6	9.8	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.03.2022	5:45-5:45	106	66.9	30.2	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2022	5:30-5:30	111	60.4	22.5	9.2	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2022	5:45-5:45	113	53.3	28.3	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.04.2022	5:30-5:30	135	64.8	33.5	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.04.2022	5:45-5:45	102	58.1	27.1	9.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.04.2022	5:30-5:30	138	59.5	35.5	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.04.2022	5:45-5:45	100	62.6	22.7	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2022	5:30-5:30	134	64.3	20.9	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.04.2022	5:45-5:45	128	56.4	29.5	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.04.2022	5:30-5:30	110	60.2	31.8	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.04.2022	5:45-5:45	107	55.8	26.6	9.8	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2022	5:30-5:30	120	67.4	34.4	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.04.2022	5:45-5:45	106	66.0	33.2	9.2	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2022	5:30-5:30	114	68.5	28.5	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.05.2022	5:45-5:45	138	59.7	20.1	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2022	5:30-5:30	121	61.3	34.3	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.05.2022	5:45-5:45	105	55.4	23.0	9.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2022	5:30-5:30	112	64.5	35.8	9.2	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.05.2022	5:45-5:45	137	52.1	21.4	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2022	5:30-5:30	109	60.3	39.9	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.05.2022	5:45-5:45	116	58.0	25.2	9.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

TABLE 3.26: AMBIENT AIR QUALITY DATA LOCATION AAQ3

Period: March – May-2022   *: AAQ3*- Cauvery Nagar   Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
04.03.2022	5:30-5:30	108	52.4	36.5	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.03.2022	5:45-5:45	125	68.3	22.9	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2022	5:30-5:30	132	56.8	38.4	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.03.2022	5:45-5:45	114	61.1	25.3	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2022	5:30-5:30	132	59.9	39.0	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.03.2022	5:45-5:45	117	64.7	35.5	9.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2022	5:30-5:30	106	53.5	28.2	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.03.2022	5:45-5:45	128	58.8	36.4	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2022	5:30-5:30	105	65.4	21.8	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2022	5:45-5:45	124	57.0	24.3	9.2	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.04.2022	5:30-5:30	109	60.4	30.7	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.04.2022	5:45-5:45	132	62.3	37.9	9.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.04.2022	5:30-5:30	114	55.1	22.4	9.2	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.04.2022	5:45-5:45	122	68.3	24.2	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2022	5:30-5:30	105	51.0	39.8	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.04.2022	5:45-5:45	133	64.5	25.0	9.8	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.04.2022	5:30-5:30	118	68.8	38.3	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.04.2022	5:45-5:45	126	52.4	36.2	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2022	5:30-5:30	108	57.4	27.7	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.04.2022	5:45-5:45	123	69.6	35.6	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2022	5:30-5:30	119	60.8	21.9	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.05.2022	5:45-5:45	121	54.0	23.3	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2022	5:30-5:30	117	62.5	34.5	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.05.2022	5:45-5:45	130	57.0	30.2	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2022	5:30-5:30	115	54.1	28.4	9.8	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.05.2022	5:45-5:45	120	58.3	35.6	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2022	5:30-5:30	104	62.7	23.0	9.2	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.05.2022	5:45-5:45	120	67.5	37.7	9.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

TABLE 3.27: AMBIENT AIR QUALITY DATA LOCATION AAQ4

Period: March – May-2022   Location: AAQ4 - Muthudaiyanpatti   Sampling Time: 24-hourly

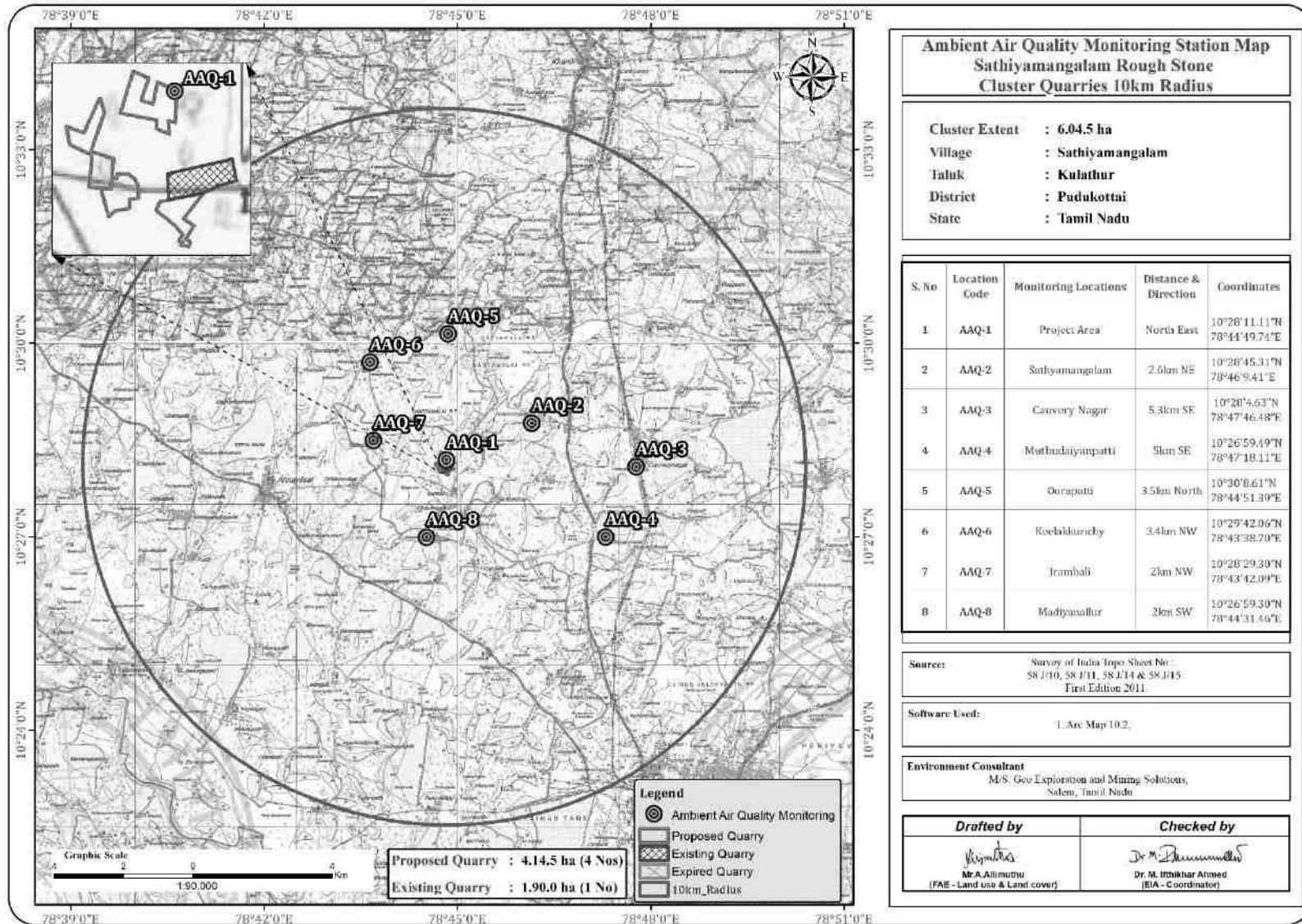| Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM$_{10}$	PM$_{2.5}$	SO$_2$	NO$_2$	NH$_3$	O$_3$	CO	Pb	Ni	As	C$_6$H$_6$	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m^3	µg/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
04.03.2022	5:30-5:30	105	55.5	25.2	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.03.2022	5:45-5:45	116	68.3	32.6	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2022	5:30-5:30	128	54.9	24.8	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.03.2022	5:45-5:45	102	65.0	33.2	9.8	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2022	5:30-5:30	133	58.6	38.0	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.03.2022	5:45-5:45	124	52.8	22.2	9.2	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2022	5:30-5:30	116	68.2	31.8	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.03.2022	5:45-5:45	108	64.8	29.5	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2022	5:30-5:30	132	56.3	25.6	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2022	5:45-5:45	121	63.5	37.4	9.8	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.04.2022	5:30-5:30	109	57.2	33.9	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.04.2022	5:45-5:45	123	62.8	24.4	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.04.2022	5:30-5:30	107	58.6	26.6	9.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.04.2022	5:45-5:45	112	69.4	25.2	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2022	5:30-5:30	138	54.9	22.5	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.04.2022	5:45-5:45	106	62.4	38.9	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.04.2022	5:30-5:30	124	55.6	21.3	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.04.2022	5:45-5:45	103	56.5	36.9	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2022	5:30-5:30	115	57.8	28.3	9.2	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.04.2022	5:45-5:45	112	62.2	37.5	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2022	5:30-5:30	127	65.2	22.0	9.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.05.2022	5:45-5:45	102	58.0	34.2	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2022	5:30-5:30	128	51.4	30.8	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.05.2022	5:45-5:45	123	53.0	26.4	9.2	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2022	5:30-5:30	134	65.8	37.6	9.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.05.2022	5:45-5:45	102	54.8	20.1	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2022	5:30-5:30	116	68.6	23.5	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.05.2022	5:45-5:45	132	65.2	34.7	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

TABLE 3.28: AMBIENT AIR QUALITY DATA LOCATION AAQ5

Period: March – May-2022:   *AAQ5*- Oorapatti   Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
04.03.2022	5:30-5:30	126	56.5	26.2	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.03.2022	5:45-5:45	102	62.4	33.6	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2022	5:30-5:30	131	55.3	28.5	9.2	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.03.2022	5:45-5:45	108	62.9	32.2	9.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2022	5:30-5:30	113	54.4	34.8	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.03.2022	5:45-5:45	104	52.8	23.9	9.2	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2022	5:30-5:30	122	65.0	28.4	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.03.2022	5:45-5:45	135	59.6	32.6	9.8	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2022	5:30-5:30	109	65.0	25.2	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2022	5:45-5:45	112	58.4	30.8	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.04.2022	5:30-5:30	127	67.8	21.5	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.04.2022	5:45-5:45	101	63.6	33.1	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.04.2022	5:30-5:30	139	64.3	20.6	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.04.2022	5:45-5:45	113	52.5	35.3	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2022	5:30-5:30	104	58.4	20.0	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.04.2022	5:45-5:45	126	61.2	34.7	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.04.2022	5:30-5:30	138	56.7	20.5	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.04.2022	5:45-5:45	102	67.9	39.9	9.8	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2022	5:30-5:30	121	50.2	20.5	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.04.2022	5:45-5:45	109	63.4	37.8	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2022	5:30-5:30	123	54.0	22.4	9.2	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.05.2022	5:45-5:45	117	69.8	35.2	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2022	5:30-5:30	136	52.1	23.1	9.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.05.2022	5:45-5:45	102	50.9	34.6	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2022	5:30-5:30	118	55.3	32.0	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.05.2022	5:45-5:45	122	63.7	26.3	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2022	5:30-5:30	104	67.5	32.1	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.05.2022	5:45-5:45	136	50.2	28.9	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

TABLE 3.29: AMBIENT AIR QUALITY DATA LOCATION AAQ6

Period: March – May-2022   *Location: AAQ6* – Keelakkurichy   Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM$_{10}$	PM$_{2.5}$	SO$_2$	NO$_2$	NH$_3$	O$_3$	CO	Pb	Ni	As	C$_6$H$_6$	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m^3	µg/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
04.03.2022	5:30-5:30	103	52.5	26.2	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.03.2022	5:45-5:45	128	69.2	33.8	9.8	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2022	5:30-5:30	102	53.9	25.4	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.03.2022	5:45-5:45	135	64.6	32.6	9.2	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2022	5:30-5:30	102	52.4	28.9	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.03.2022	5:45-5:45	124	58.5	39.2	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2022	5:30-5:30	102	66.0	21.4	9.2	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.03.2022	5:45-5:45	136	55.8	33.1	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2022	5:30-5:30	113	58.1	24.8	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2022	5:45-5:45	128	52.4	32.5	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.04.2022	5:30-5:30	132	61.0	35.2	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.04.2022	5:45-5:45	127	65.5	38.1	9.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.04.2022	5:30-5:30	102	52.9	36.5	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.04.2022	5:45-5:45	129	63.8	27.2	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2022	5:30-5:30	112	57.5	22.1	9.2	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.04.2022	5:45-5:45	124	61.2	34.4	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.04.2022	5:30-5:30	122	52.3	26.5	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.04.2022	5:45-5:45	108	63.5	33.3	9.8	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2022	5:30-5:30	132	66.6	25.9	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.04.2022	5:45-5:45	105	59.7	32.8	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2022	5:30-5:30	112	65.1	21.2	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.05.2022	5:45-5:45	119	54.4	24.1	9.8	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2022	5:30-5:30	128	51.9	38.3	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.05.2022	5:45-5:45	102	62.6	25.8	9.2	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2022	5:30-5:30	134	63.5	36.2	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.05.2022	5:45-5:45	115	59.3	39.8	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2022	5:30-5:30	100	64.4	25.4	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.05.2022	5:45-5:45	139	52.3	34.1	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

TABLE 3.30: AMBIENT AIR QUALITY DATA LOCATION AAQ7

Period: March – May-2022   *Location: AAQ7*– Irambali   Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM$_{10}$	PM$_{2.5}$	SO$_2$	NO$_2$	NH$_3$	O$_3$	CO	Pb	Ni	As	C$_6$H$_6$	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
04.03.2022	5:30-5:30	125	53.9	38.8	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.03.2022	5:45-5:45	132	62.6	22.2	9.2	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2022	5:30-5:30	111	51.3	36.3	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.03.2022	5:45-5:45	109	64.4	24.4	9.8	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2022	5:30-5:30	123	58.1	32.9	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.03.2022	5:45-5:45	104	67.2	26.6	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2022	5:30-5:30	132	51.8	38.2	9.2	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.03.2022	5:45-5:45	128	62.5	25.1	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2022	5:30-5:30	115	53.6	33.9	9.8	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2022	5:45-5:45	102	59.3	34.3	9.2	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.04.2022	5:30-5:30	125	68.5	31.5	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.04.2022	5:45-5:45	138	67.4	25.7	9.2	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.04.2022	5:30-5:30	126	51.1	20.1	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.04.2022	5:45-5:45	113	62.2	22.4	9.2	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2022	5:30-5:30	101	54.5	26.2	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.04.2022	5:45-5:45	125	67.8	39.6	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.04.2022	5:30-5:30	138	61.6	30.8	9.8	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.04.2022	5:45-5:45	101	62.3	22.3	10.3	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2022	5:30-5:30	112	56.5	34.5	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.04.2022	5:45-5:45	123	65.4	20.6	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2022	5:30-5:30	139	58.8	36.2	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.05.2022	5:45-5:45	124	62.2	20.2	10.3	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2022	5:30-5:30	112	54.9	38.8	9.8	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.05.2022	5:45-5:45	101	66.3	20.4	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2022	5:30-5:30	135	55.7	33.6	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.05.2022	5:45-5:45	124	62.1	35.2	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2022	5:30-5:30	118	53.3	30.1	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.05.2022	5:45-5:45	133	68.3	38.9	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

TABLE 3.31: AMBIENT AIR QUALITY DATA LOCATION AAQ8

Period: March – May-2022   *Location: AAQ8*– Madiyanallur   Sampling Time: 24-hourly

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM$_{10}$	PM$_{2.5}$	SO$_2$	NO$_2$	NH$_3$	O$_3$	CO	Pb	Ni	As	C$_6$H$_6$	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m^3	µg/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
04.03.2022	5:30-5:30	127	51.3	26.6	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.03.2022	5:45-5:45	102	69.6	30.2	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2022	5:30-5:30	136	53.2	21.3	9.2	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.03.2022	5:45-5:45	118	54.8	39.1	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2022	5:30-5:30	101	62.1	28.9	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.03.2022	5:45-5:45	123	58.5	36.3	8.7	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2022	5:30-5:30	138	63.9	26.5	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.03.2022	5:45-5:45	104	51.3	33.7	8.7	22.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2022	5:30-5:30	125	68.5	21.3	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2022	5:45-5:45	119	52.7	32.6	9.8	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
01.04.2022	5:30-5:30	123	55.4	25.4	10.3	23.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
02.04.2022	5:45-5:45	126	57.2	31.2	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
08.04.2022	5:30-5:30	139	54.3	27.8	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.04.2022	5:45-5:45	105	62.6	36.3	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2022	5:30-5:30	132	63.8	23.6	9.2	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.04.2022	5:45-5:45	108	54.7	25.4	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22.04.2022	5:30-5:30	137	51.4	27.2	8.7	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.04.2022	5:45-5:45	121	63.1	34.8	10.3	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2022	5:30-5:30	115	55.2	33.5	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
29.04.2022	5:45-5:45	103	64.3	32.2	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2022	5:30-5:30	121	59.6	25.6	9.8	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.05.2022	5:45-5:45	138	68.9	29.9	8.7	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2022	5:30-5:30	107	66.8	24.4	8.7	21.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.05.2022	5:45-5:45	122	63.7	38.7	9.2	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2022	5:30-5:30	116	59.4	25.3	10.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.05.2022	5:45-5:45	109	54.1	32.5	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2022	5:30-5:30	121	59.0	25.7	10.3	20.7	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.05.2022	5:45-5:45	134	60.8	36.3	8.7	21.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Legend: **PM2.5**-Particulate Matter size less than 2.5 µm; **PM10**-Respirable Particulate Matter size less than 10 µm; **SO₂**-Sulphur dioxide; **NOx**-Oxides of Nitrogen**;NH₃**-Ammonia; **O₃**-Ozone; **CO**-Carbon monoxide; **Pb**-Particulate Lead; **As**-Particulate Arsenic; **Ni**-Particulate Nickel; **C₆H₆**-Benzene &**BaP**- Benzo (a) pyrene inparticulate phase **NAAQ Norms-**National Ambient Air Quality Norms-**Revised as per GSR 826(E) dated 16.11.2009** for Industrial, Residential, Rural and other Area.

TABLE 3.32: SUMMARY OF AAQ – 1 to AAQ – 8

Particulate matter PM-2.5			
Station ID	**Max**	**Min**	**Mean**
AAQ-1	38.9	22.4	30.14
AAQ-2	39.9	20.1	29.10
AAQ-3	39.8	21.8	30.73
AAQ-4	38.9	20.1	29.46
AAQ-5	39.9	20	29.09
AAQ-6	39.8	21.2	30.52
AAQ-7	39.6	20.1	29.99
AAQ-8	39.1	21.3	29.72
Particulate matter PM-10			
Station ID	**Max**	**Min**	**Mean**
AAQ-1	68.5	51.1	59.29
AAQ-2	68.5	51.5	59.96
AAQ-3	69.6	51	60.16
AAQ-4	69.4	51.4	60.26
AAQ-5	69.8	50.2	59.35
AAQ-6	69.2	51.9	59.31
AAQ-7	68.5	51.1	60.12
AAQ-8	69.6	51.3	59.29
Sulphur Di-oxide as SO2			
Station ID	**Max**	**Min**	**Mean**
AAQ-1	10.3	8.7	9.46
AAQ-2	10.3	8.7	9.5
AAQ-3	10.3	8.7	9.44
AAQ-4	10.3	8.7	9.42
AAQ-5	10.3	8.7	9.44
AAQ-6	10.3	8.7	9.5
AAQ-7	10.3	8.7	9.47
AAQ-8	10.3	8.7	9.46
Oxide of Nitrogen as NO2			
Station ID	**Max**	**Min**	**Mean**
AAQ-1	23.7	20.7	22.11
AAQ-2	23.7	20.7	22.38
AAQ-3	23.7	20.7	22.07
AAQ-4	23.7	20.7	22.02
AAQ-5	23.7	20.7	22.05
AAQ-6	23.7	20.7	22.04
AAQ-7	23.7	20.7	22.14
AAQ-8	23.7	20.7	21.79

TABLE 3.26: ABSTRACT OF AMBIENT AIR QUALITY DATA

Sl. No.	Parameter	Pollutant Concentration, µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NO_2
1	No. of Observations	224	224	224	224
2	10th Percentile Value	20.90	42.20	7.22	20.10
3	20th Percentile Value	21.60	42.70	7.56	21.16
4	30th Percentile Value	22.30	43.02	7.90	21.70
5	40th Percentile Value	23.02	43.30	8.10	22.20
6	50th Percentile Value	23.50	43.70	8.10	22.60
7	60th Percentile Value	24.10	44.14	8.20	23.10
8	70th Percentile Value	24.50	45.02	8.40	23.30
9	80th Percentile Value	24.90	46.02	8.60	23.70
10	90th Percentile Value	25.70	46.60	8.80	24.50
11	95th Percentile Value	26.50	46.90	9.10	24.90
12	98th Percentile Value	26.81	47.63	9.20	25.70
13	**Arithmetic Mean**	**23.98**	**44.66**	**8.29**	**23.00**
14	**Geometric Mean**	23.91	44.62	8.27	22.94
15	**Standard Deviation**	1.94	1.88	0.61	1.67
16	**NAAQ Norms***	**60**	**100**	**80**	**80**
17	**% Values exceeding Norms***	**0**	**0**	**0**	**0**

Legend: $PM_{2.5}$-Particulate Matter size less than 2.5 µm; PM_{10}-Respirable Particulate Matter size less than 10 µm; SO_2-Sulphur dioxide; NO_x-Oxides of Nitrogen; CO-Carbon monoxide; O_3-Ozone; NH_3-Ammonia;

Pb-Particulate Lead; As-Particulate Arsenic; Ni-Particulate Nickel; C_6H_6-Benzene & BaP- Benzo (a) pyrene in particulate phase levels were monitored below their respective detectable limits

* NAAQ Norms-National Ambient Air Quality Norms-Revised as per GSR 826(E) dated 16.11.2009 for Industrial, Residential, Rural and other Areas

FIGURE 3.24: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ 8

Summary of Ambient Air Quality Data (AAQ 1 - AAQ8)

	PM10	PM2.5	SO2	NO2
■ 98th Percentile Value	39.8	69.5	10.3	23.7
■ Arithmetic Mean	31.6	61.4	9.6	22.3
■ Minimum	22.1	52.3	8.7	20.7
■ Maximum	39.8	69.5	10.3	23.7
■ NAAQ Norms*	60.0	100.0	80.0	80.0
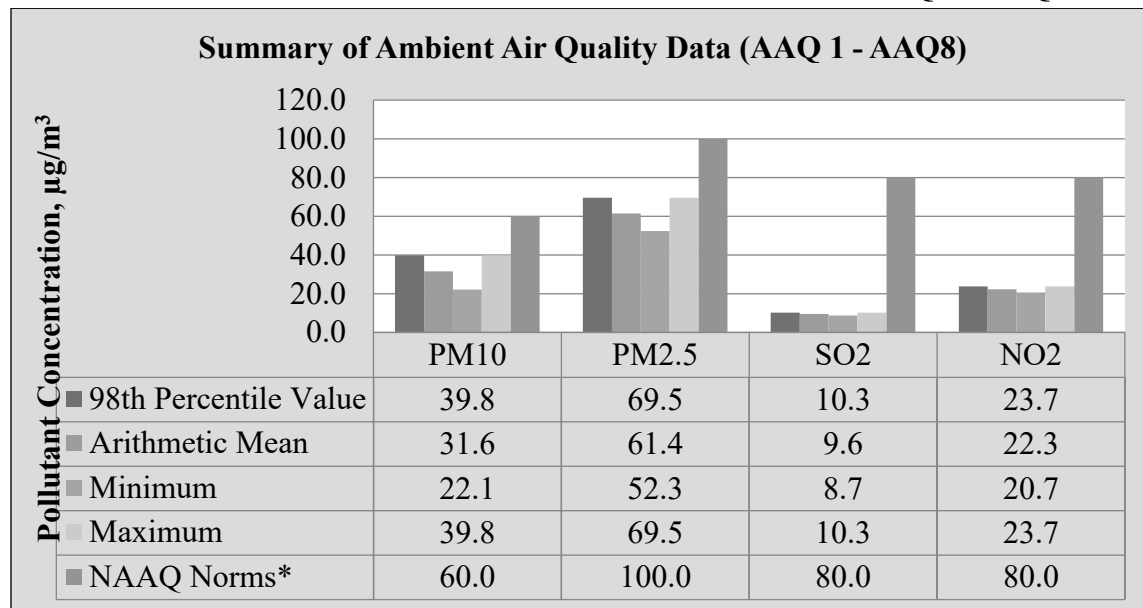
Source: Table 3.17 to 3.27

FIGURE 3.25: BAR DIAGRAM OF PARTICULATE MATTER PM$_{2.5}$

Particulate Matter (PM$_{2.5}$, µg/m^3)

	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
■ Arithmetic Mean	30.1	29.8	30.7	29.5	29.1	30.5	30.0	29.7
■ Minimum	22.4	20.1	21.8	20.1	20.0	21.2	20.1	21.3
■ Maximum	38.9	39.9	39.8	38.9	39.9	39.8	39.6	39.1
■ NAAQ Norms	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
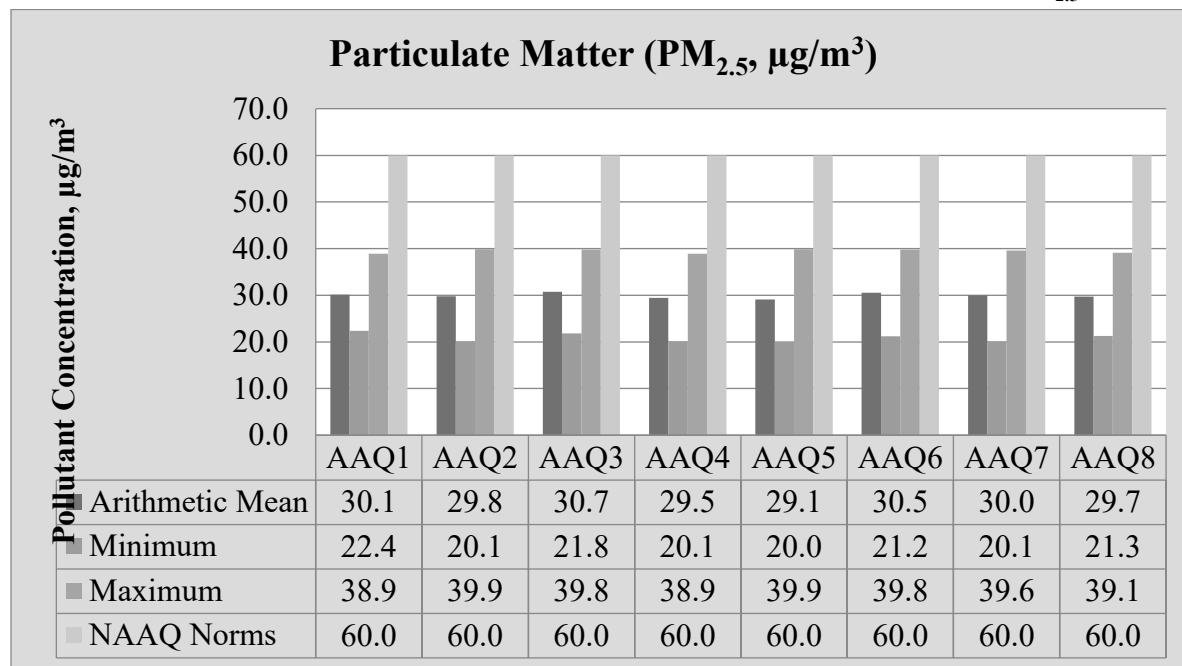
Source: Table 3.17 to 3.27

FIGURE 3.26: BAR DIAGRAM OF PARTICULATE MATTER PM$_{10}$

Particulate Matter (PM$_{10}$, µg/m^3)

Pollutant Concentration, µg/m^3	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	59.3	59.9	60.2	60.5	59.4	59.3	60.1	59.3
Minimum	51.1	51.5	51.0	51.4	50.2	51.9	51.1	51.3
Maximum	68.5	68.5	69.6	69.4	69.8	69.2	68.5	69.6
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
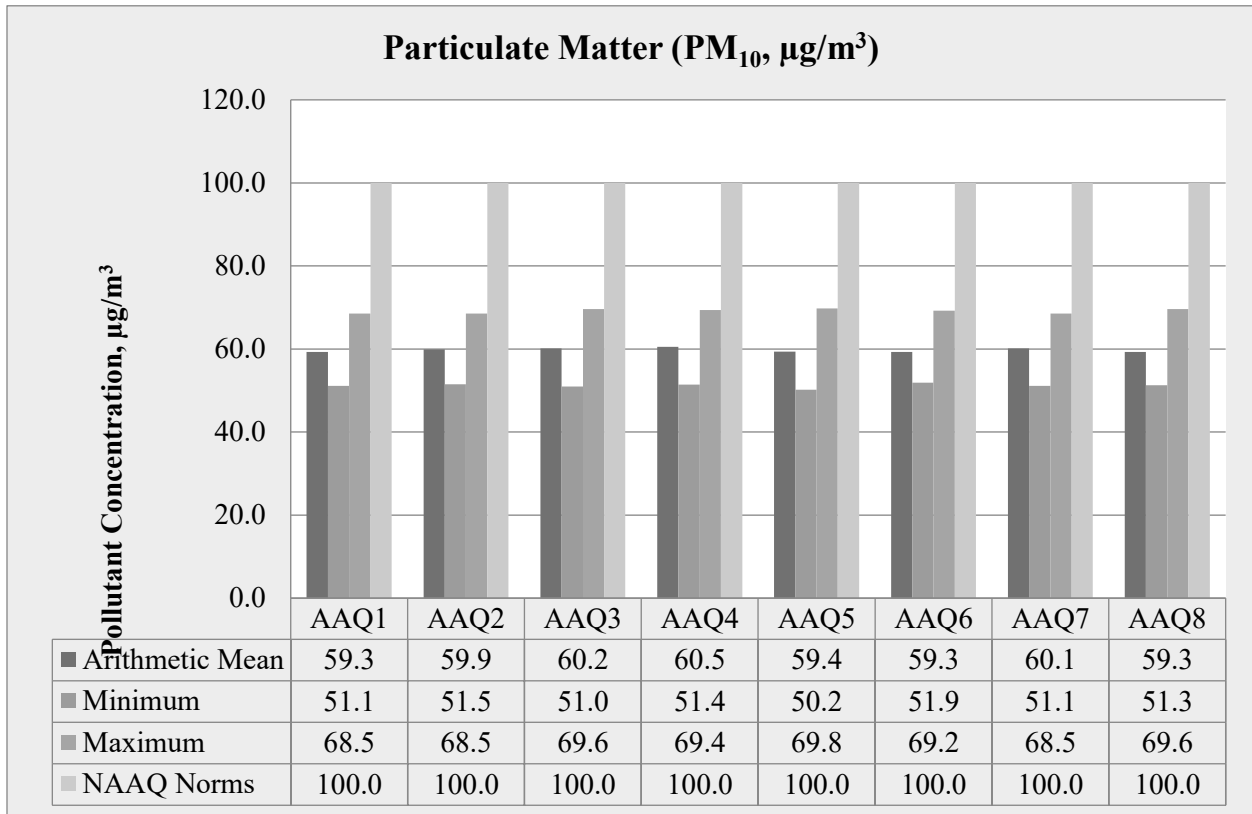
Source: Table 3.17 to 3.27

FIGURE 3.27: BAR DIAGRAM OF GASEOUS POLLUTANT SO$_2$

Gaseous Pollutant (SO$_2$, µg/m^3)

Pollutant Concentration, µg/m^3	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	9.5	9.5	9.4	9.4	9.4	9.5	9.5	9.5
Minimum	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7
Maximum	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
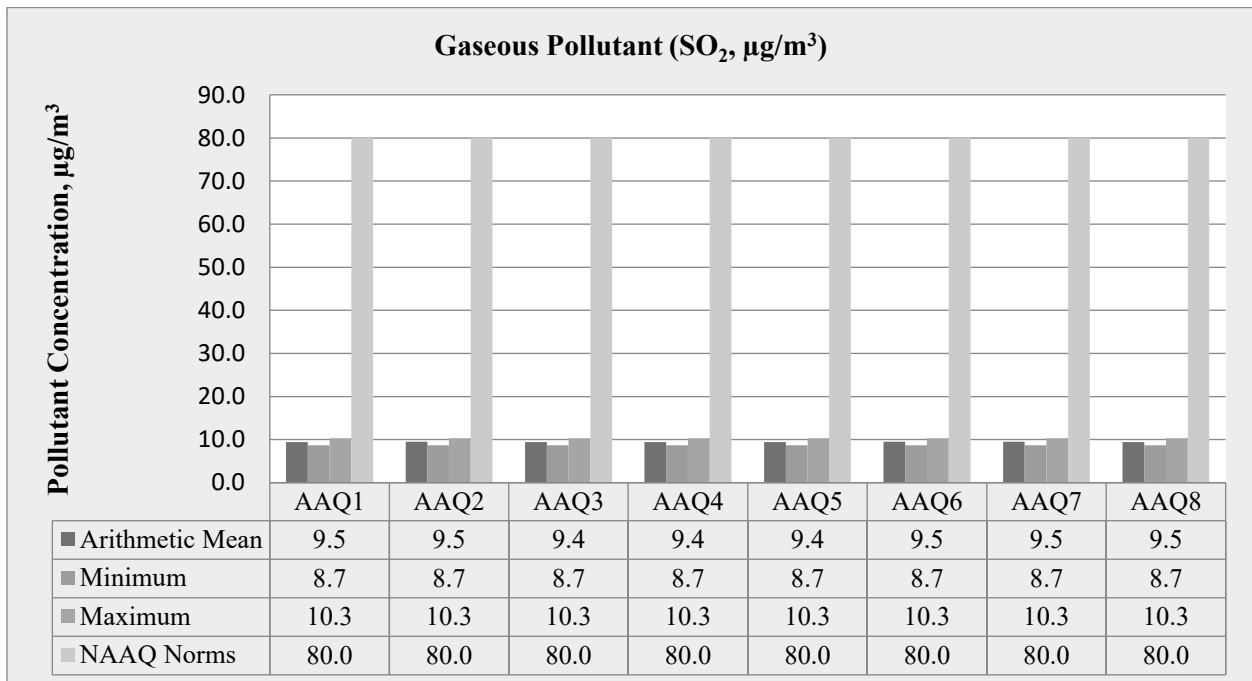
Source: Table 3.17 to 3.27

FIGURE 3.28: BAR DIAGRAM OF GASEOUS POLLUTANT NO$_x$

Gaseous Pollutant (NOx, µg/m³)

	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
■ Arithmetic Mean	22.1	22.4	22.1	22.0	22.1	22.0	22.1	21.8
■ Minimum	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7
■ Maximum	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7
■ NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
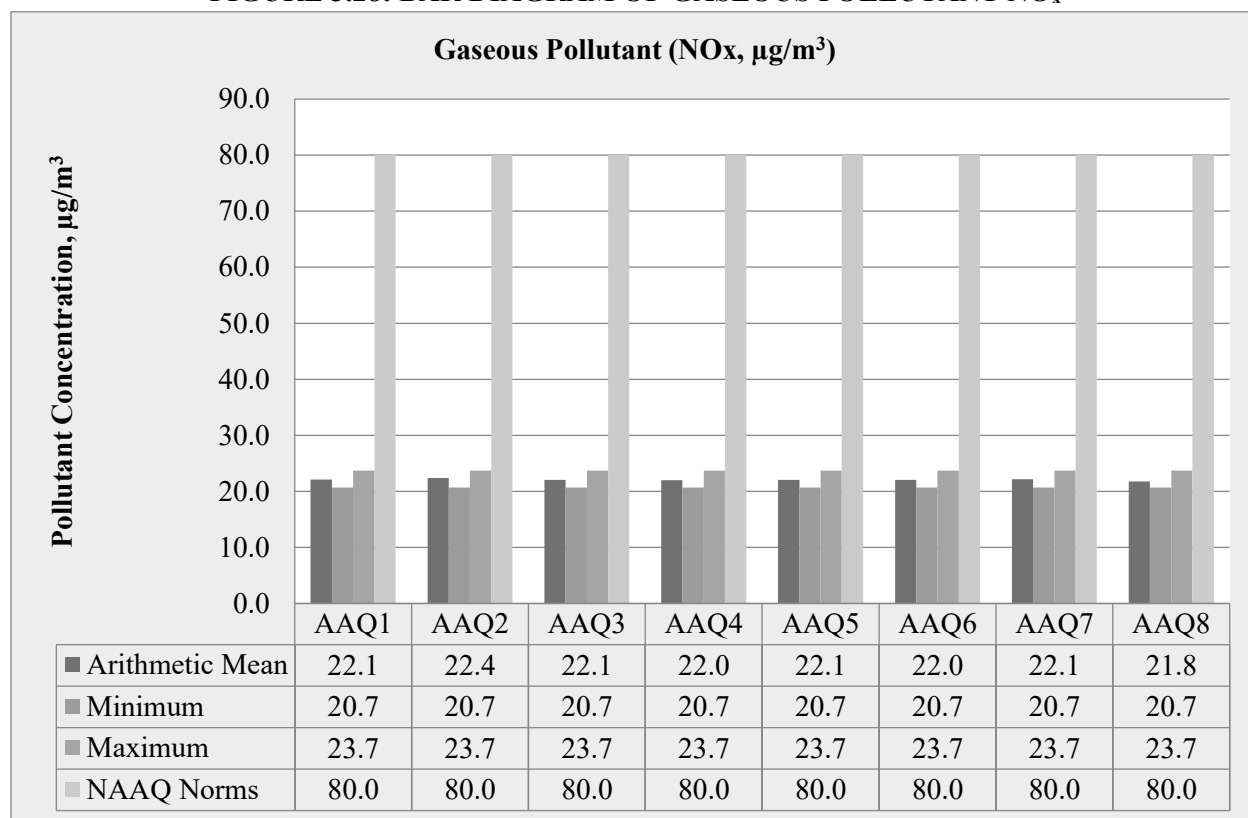
Source: Table 3.17 to 3.27

3.3.6   Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from 50.2 µg/m³ to 69.8 µg/m³, $PM_{2.5}$ data ranges from 20.0 µg/m³ to 39.9 µg/m³, SO_2 ranges from 8.7 µg/m³ to 10.3 µg/m³ and NO_2 data ranges from 20.7 µg/m³ to 23.7 µg/m³. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

3.3.7   FUGITIVE DUST EMISSION

Fugitive dust was recorded at 8 AAQ monitoring stations for 30 days average during the study period.

TABLE 3.34: AVERAGE FUGITIVE DUST SAMPLE VALUES

AAQ Locations	Avg SPM (µg/m³)
AAQ 1	64.13
AAQ 2	60.17
AAQ 3	65.18
AAQ 4	60.49
AAQ 5	61.19
AAQ 6	64.85
AAQ 7	64.73
AAQ 8	60.20

Source: Onsite monitoring/ sampling by Chennai Mettex Laboratories

FIGURE 3.29: LINE DIAGRAM OF AVERAGE SPM VALUES

Avg SPM (µg/m³)

	AAQ 1	AAQ 2	AAQ 3	AAQ 4	AAQ 5	AAQ 6	AAQ 7	AAQ 8
Series1	63.4	64.73	64.85	61.19	60.49	65.18	60.25	64.13
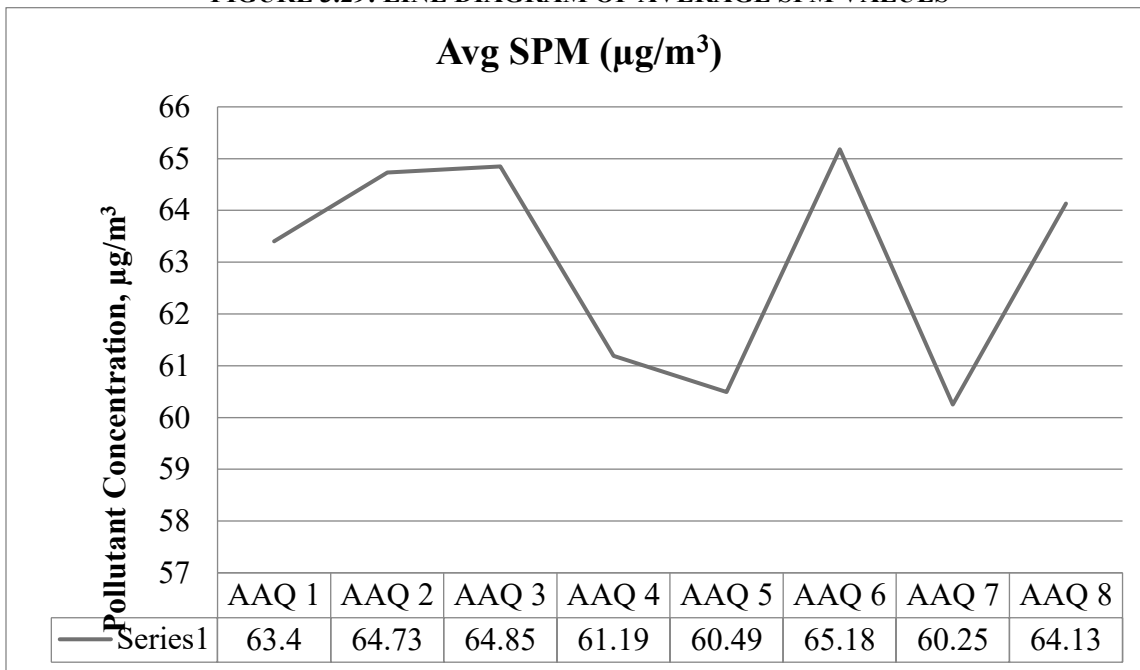
Source: Table 3.28

TABLE 3.35: FUGITIVE DUST SAMPLE VALUES IN µg/m³

SPM (µg/m3)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Average	63.4	64.73	64.85	61.19	60.49	65.18	60.25	64.13
Min	55.3	63.1	61.70	58.8	58.8	63.2	56.60	62.3
Max	62.8	67.8	68.90	64.10	63.1	66.70	62.90	66.8

Source: Calculations from Lab Analysis Reports

FIGURE 3.30: BAR DIAGRAM OF SPM VALUES

SPM (µg/m³)

■ Average ■ Max ■ Min

	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Min	130.4	132.1	102.7	99.8	114.8	94.2	89.1	81.6
Max	139.1	136.4	114.7	109.7	124.5	107.4	100.8	94.9
Average	136.9	135.6	110.9	107.4	121.4	101.8	97.3	91.7
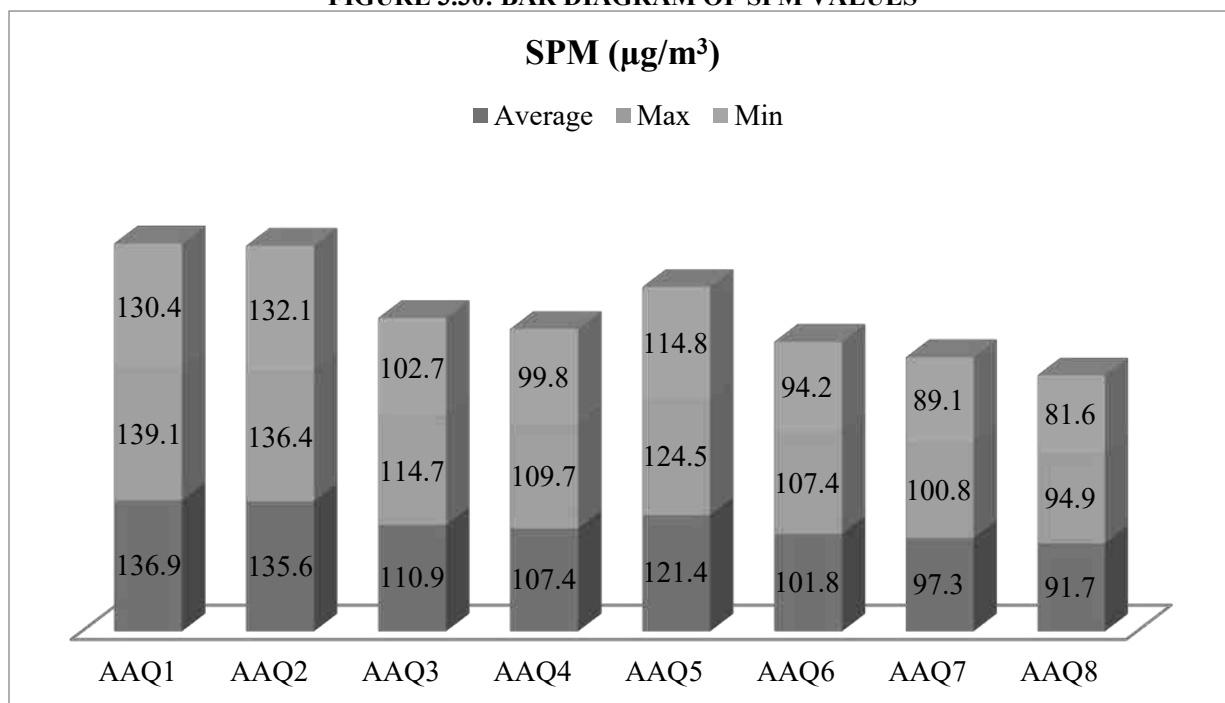
Source: Table 3.29

3.4   NOISE ENVIRONMENT

The vehicular movement on road and mining activities is the major sources of noise in study area, the environmental assessment of noise from the mining activity and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance and general community responses.

The main objective of noise monitoring in the study area is to establish the baseline noise level and assess the impact of the total noise expected to be generated during the project operations around the project site.

3.4.1   Identification of Sampling Locations

In order to assess the ambient noise levels within the study area, noise monitoring was carried out at eight (8) locations. The noise level monitoring locations were carried out by covering commercial, residential, rural areas within the radius of 10km. A noise monitoring methodology was chosen such that it best suited the purpose and objectives of the study.

TABLE 3.36: DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Project area	North west corner	10°28'12.28"N 78°44'46.88"E
2	N-2	Sathyamangalam	2.6km NE	10°28'45.48"N 78°46'09.21"E
3	N-3	Cauvery nagar	5.2km SE	10°28'02.40"N 78°47'45.35"E
4	N-4	Muthudaiyanpatti	4.5km SE	10°26'53.80"N 78°46'59.68"E
5	N-5	Oorapatti	3.4km North	10°30'03.90"N 78°44'52.94"E
6	N-6	Keelakkurichy	3.0km NW	10°29'32.10"N 78°43'41.22"E
7	N-7	Irambali	2km NW	10°28'31.18"N 78°43'42.88"E
8	N-8	Madiyanallur	2km SW	10°26'59.65"N 78°44'31.60"E

3.4.2   Method of Monitoring

Digital Sound Level Meter was used for the study. All reading was taken on the 'A-Weighting' frequency network, at a height of 1.5 meters from ground level. The sound level meter does not give a steady and consistent reading and it is quite difficult to assess the actual sound level over the entire monitoring period. To mitigate this shortcoming, the Continuous Equivalent Sound level, indicated by Leq, is used. Equivalent sound level, 'Leq', can be obtained from variable sound pressure level, 'L', over a time period by using following equation. The equivalent noise level is defined mathematically as

Measured noise levels, displayed as a function of time, is useful for describing the acoustical climate of the community. Noise levels recorded at each station with a time interval of about 60 minutes are computed for equivalent noise levels. Equivalent noise level is a single number descriptor for describing time varying noise levels.

Leq = 10 Log L / T$\sum$ (10Ln/10)

Where L = Sound pressure level at function of time dB (A)

T = Time interval of observation

FIGURE 3.31: NOISE MONITORING STATIONS AROUND 10 KM RADIUS
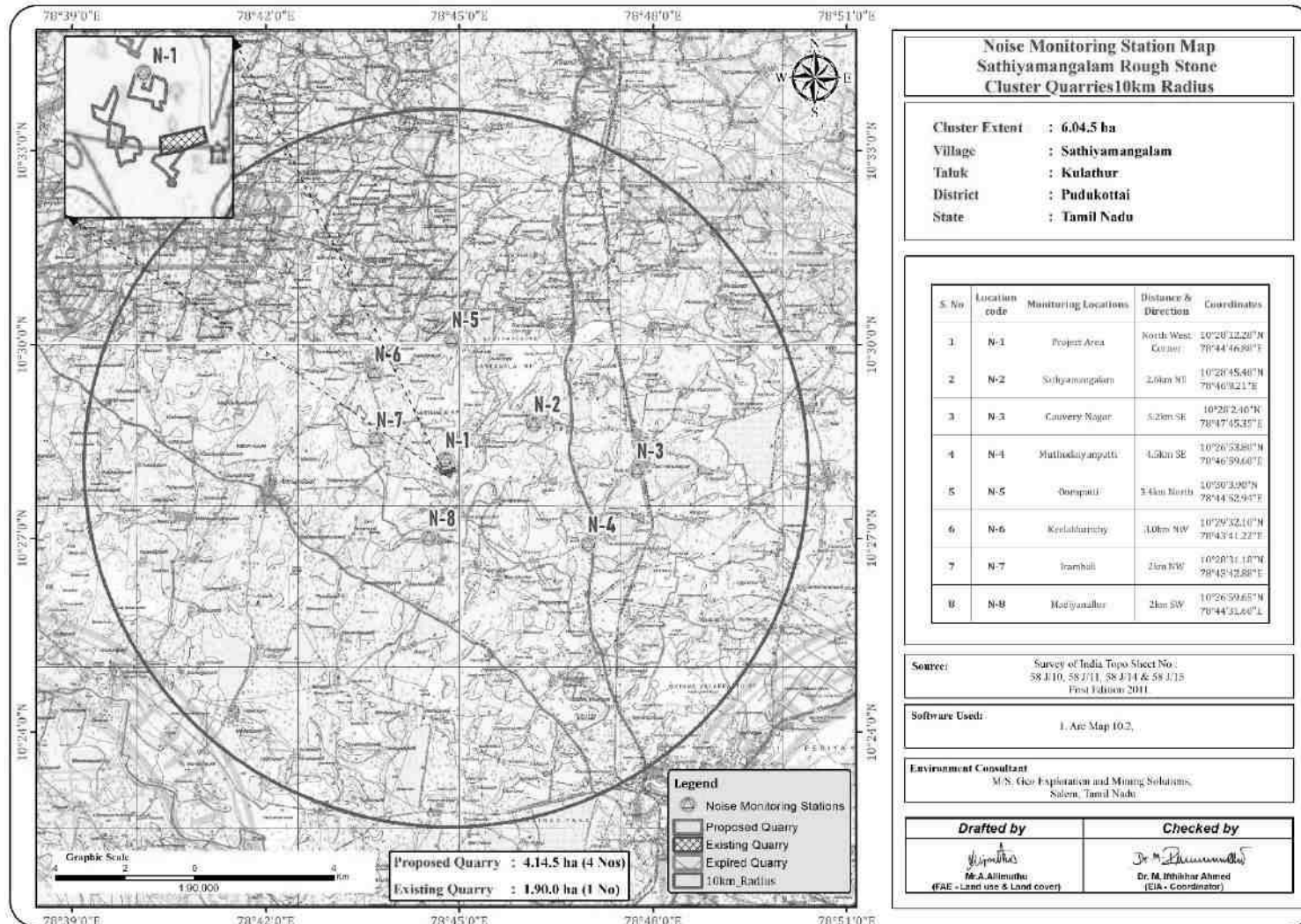
3.4.3   Analysis of Ambient Noise Level in the Study Area

The Digital Sound pressure level has been measured by a sound level meter (Model: HTC SL-1352)
An analysis of the different Leq data obtained during the study period has been made. Variation was

noted during the day-time as well as night-time. The results are presented in below Table 3.31

Day time: 6:00 hours to 22.00 hours.

Night time: 22:00 hours to 6.00 hours.

TABLE 3.37: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Project area	60.9	52.6	**Industrial** **Day Time- 75 dB (A)** **Night Time- 70 dB (A)**
2	Sathyamangalam	52.2	42.4	
3	Cauvery nagar	52.0	42.2	
4	Muthudaiyanpatti	51.9	42.1	
5	Oorapatti	52.5	42.0	**Residential** **Day Time– 55 dB (A)** **Night Time- 45 dB (A)**
6	Keelakkurichy	52.0	42.8	
7	Irambali	51.8	42.6	
8	Madiyanallur	51.4	42.4	

Source: On-site monitoring/sampling by Chennai Mettex Laboratories in association with GEMS

FIGURE 3.32: DAY TIME NOISE LEVELS IN CORE AND BUFFER ZONE

	N1	N2	N3	N4	N5	N6	N7	N8
■ Day Time (dB (A) Leq)	60.9	52.2	52.0	51.9	52.5	52.0	51.8	51.4
■ Standards	75	75	55	55	55	55	55	55
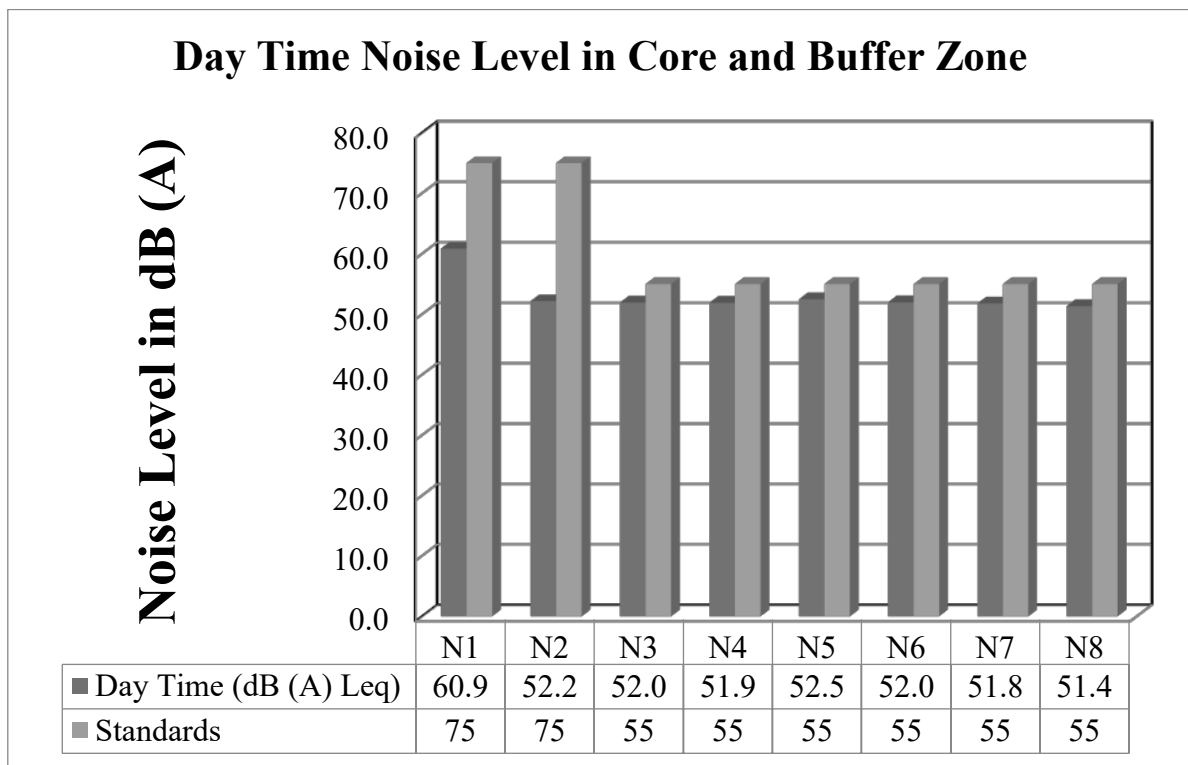
FIGURE 3.33: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE

Night Time Noise Level in Core and Buffer Zone

	N1	N2	N3	N4	N5	N6	N7	N8
■ Night Time (dB (A) Leq)	52.6	42.4	42.2	42.1	42.0	42.8	42.6	42.4
■ Standards	70	70	45	45	45	45	45	45
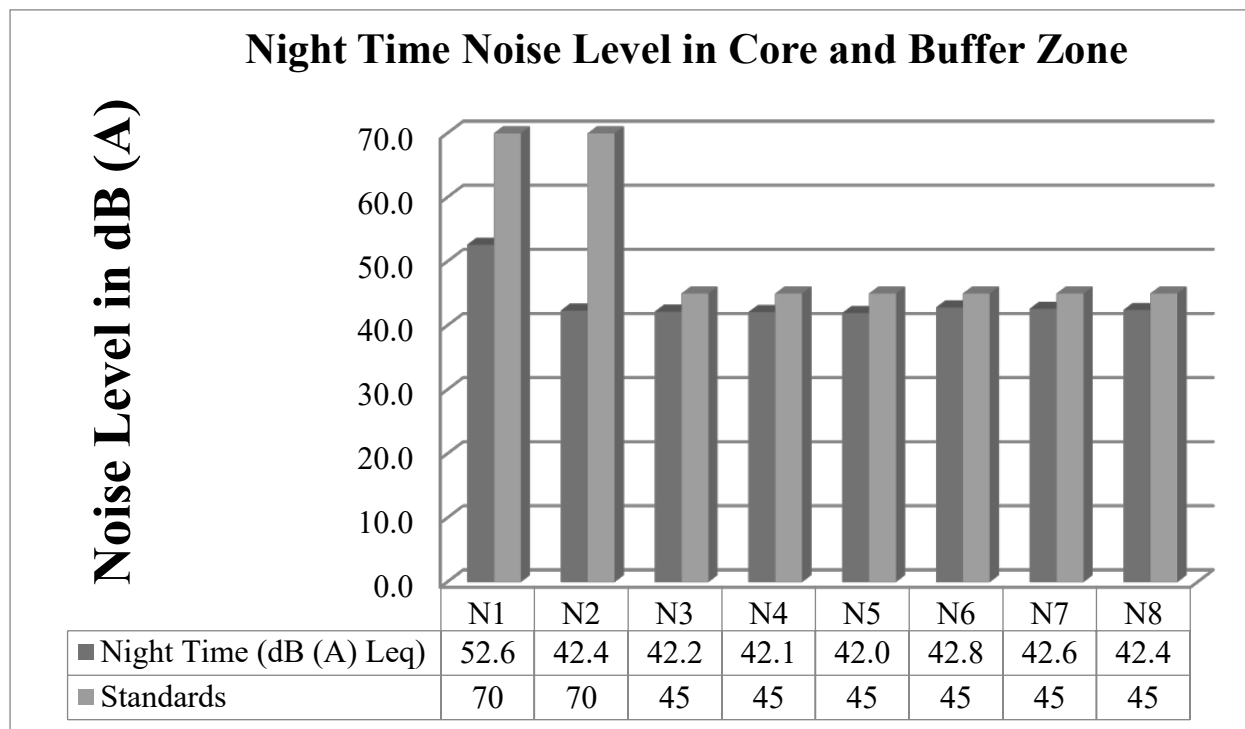
3.4.4   Interpretation & Conclusion:

Ambient noise levels were measured at 8 (Eight) locations around the proposed project area. Noise levels recorded in core zone during day time were from 60.9 dB (A) Leq and during night time were from 52.6dB (A) Leq. Noise levels recorded in buffer zone during day time were from 51.4to 52.5 dB (A) Leq and during night time were from 42.0 to 42.8 dB (A) Leq.

Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.5   BIOLOGICAL ENVIRONMENT

3.5.1. Study area Ecology

The core area extent of 1.34.0 Ha of Rough stone quarry has an impact on diversity of flora and fauna of the surrounding area. But present work was carried out on detailed study of the impacts of Rough stone quarry on the ecology and biodiversity of the core lease area with the proper mitigation and sustainable management plan. The Core mining area is situated with exibit plain topography. whereas in buffer zone some places agricultural land is dominated. The following methods were applied during the baseline study of flora, fauna and diversity assessment.

3.5.2. Objectives of Biological Studies

a) To study the likely impact of the proposed mining project on the local biodiversity and to suggest mitigation measures, if required, for vulnerable biota.
b) To assess the nature and distribution of vegetation Terrestrial in and around the mining activity.
c) To identify the impacts of mining on agricultural lands and how it affects.
d) Proper collection of information about wildlife Sanctuaries/ national parks/ biosphere reserves of the project area.
e) Devise management & conservation measures for biodiversity.

3.5.3. Methodology of Sampling

1. Field survey was conducted by visual encounter survey for flora present within the 10 km radius study area of proposed mine site.
2. After surveying the core and buffer areas, a detailed floral inventory has been compiled. List of all plants in the study area was prepared and their habitats were recorded.
3. Verification of Rare, Endangered, and Threatened Flora species from IUCN Red Data Book.

In order to provide representative ecological status for the study area, the 10-km buffer zone has been divided into four quartiles for biodiversity sampling, i.e., NE (Quartile-1), NW (Quartile-2) SW (Quartile-3) and SE (Quartile-4). Each of the quartiles have been examined for representative flora on randomly sampled quadrats for trees (10x10-m), shrubs (5x5-m) and herbs (1x1-m) depending upon prevailing geographical conditions and bio-diversity aspects of the study area.

3.5.4. Floral analysis:

The vegetation structure of the region was randomly checked at selected habitats and sampling was done study area. Most of the buffer zone area is under cultivation and hence sampling near pond side and road side are restricted to dense covered regions.

Quadrats of 10 × 10-m were laid down randomly within the core and 5-km buffer area; each quadrat was laid to assess the trees (>5 cm GBH) and one, 5 × 5-m sub-quadrat nested within the quadrat for shrubs. The quadrats were laid randomly to cover the area to maximize the sampling efforts and minimize the species homogeneity, such as small stream areas, trees in agricultural bunds, tank bunds, farm forestry plantations, wildlife areas, and natural forest area, avenue plantations, house backyards, etc. In each quadrat individuals belonging to tree (10 × 10-m) and shrub (5 × 5-m) were recorded separately and have been identified on the field. Only photographs were taken during the field survey and no damage is created to flora and fauna during the sampling. The plants were identified using floras by Gamble (1915-36), Saxena and Brahmam (1994-96), Nair and Henry (1983), Henry et al. (1987), Henry et al. (1989) and also by using updated check list from www.theplantlist.org.

3.5.5. Flora Composition in the Core Zone

Taxonomically a total of 18 species belonging to 15 families have been recorded from the core mining lease area. The lease applied area is exhibit plain topography. The area has gentle sloping towards Eastern side. Based on the habitat classification of the enumerated plants the majority of species were Herbs 8 (44%) followed by Trees 4 (22%), Shrubs 4 (22%), Creeper 1 (6%), Grass 1 (6%). Details of flora with the scientific name were mentioned in Table No. 3.1. The result of the core zone of flora studies shows that Fabaceae and Lamiaceae are the main dominating species in the study area mentioned in Table No.3.1 and the details of the diversity of flora family's patterns are given in Fig No.3.3.

Table No: 3.1. Flora in the Core zone of Thiru.Rengaraj, Rough stone quarry

SI. No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Neem	Vembu	*Azadirachta indica*	Meliaceae
2.	Mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae
3.	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae
4.	Banyan tree	Alamaram	*Ficus benghalensis*	Moraceae
Shrubs				
1.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae
2.	Tanner's cassia	Avaram	*Senna auriculata*	Fabaceae
3.	Lantana	Unni chedi	*Lantana camara*	Verbenaceae
4.	Night shade plan	Sundaika	*Solanum torvum*	Solanaceae
Herbs				
1.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
2.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae

3.	Coat buttons	Thatha poo	*Tridax procumbens*	Asteraceae
4.	Bindii	Nerunji mullu	*Tribulus terrestris*	Zygophyllaceae
5.	Dog Mustard	Nai kadugu plant	*Cleome viscosa*	Cleomaceae
6.	Prickly chaff flower	Nayuruv	*Achyranthes aspera*	Amaranthaceae
7.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae
8.	Ban Tulsi	Melakai poondu	*Croton bonplandianus*	Euphorbiaceae
Creeper				
1.	Nut grass	Korai	*Cyperus rotandus*	Poaceae
Grass				
1.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae

(**Sources**: Species observation in the field study)

a. Calotropis gigantea

b. Solanum Xanthocarpum

c. Tridax procumbens

d. Cyperus rotandus

e. Cynodon dactylon

f. Borassus flabellifer

g. Ficus benghalensis

h. Senna auriculata

i. Azadirachta indica

j. Prosopis juliflora

Fig No: 3.1. Species observation in the field study (Core Zone)

3.5.6. Flora Composition in the Buffer Zone

A similar type of environment is also in the buffer area but with more flora diversity compared to the core zone area because of the vegetation in all the directions. The lease applied area is exhibit plain topography. It contains a total of 82 species belonging to 36 families that have been recorded from the buffer zone. The floral (82) varieties among them Thirty Trees 30 (37%) twenty-five herbs 25 (30%) and Thirteen shrubs 13 (16%) and eight Climbers 8 (10%), four Grasses 4 (5%), one Creepers 1 (1%) and one Cactus 1 (1%) were identified. The result of the buffer zone of flora studies shows that Fabaceae and Solanaceae, Euphorbiaceae is the main dominating species in the study area mentioned in Table No.3.2. There are no impacts due to this mining activity.

There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. Details of flora with the scientific name were mentioned in Table No.3.2. The diversity of flora families is given in Fig No.3.5.
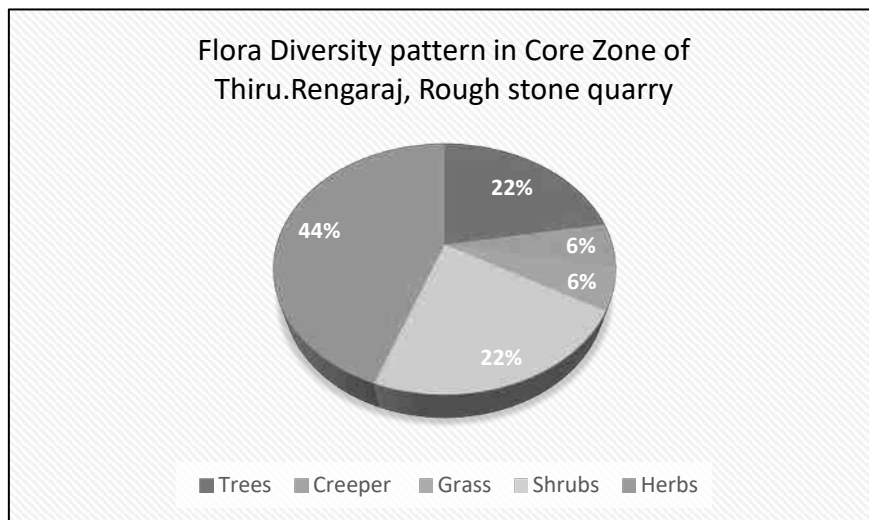
Fig No: 3.2. Flora Diversity pattern in Core Zone of Thiru.C.Rengaraj
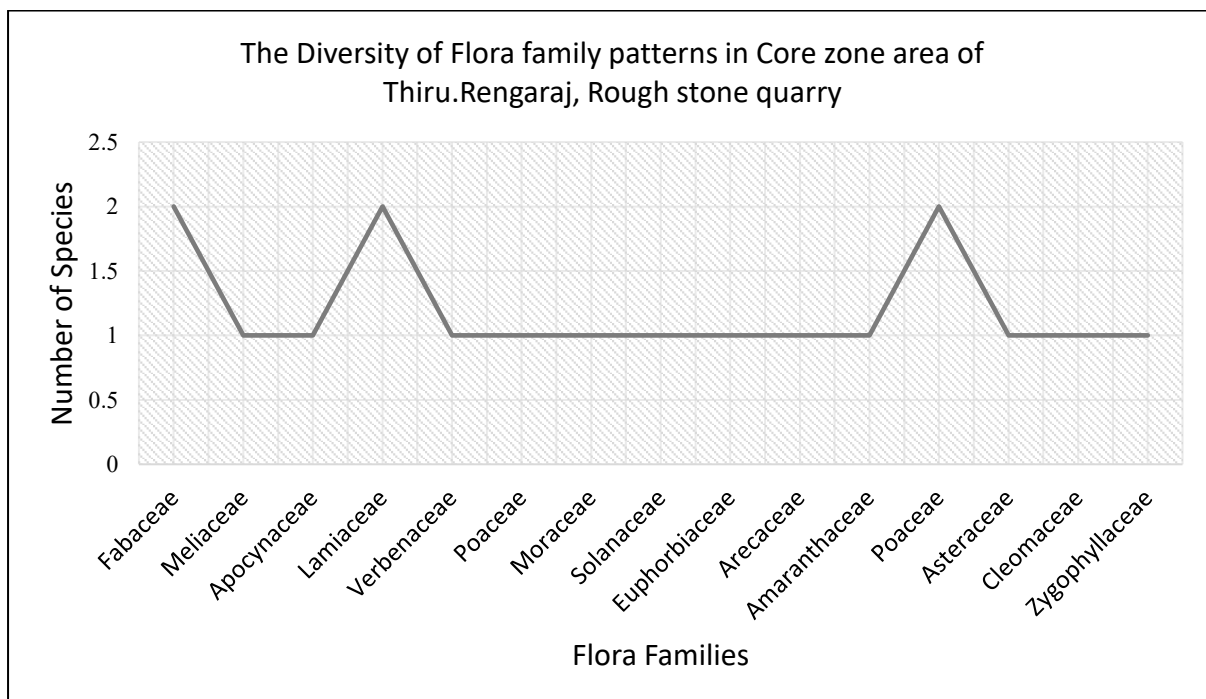
Fig No: 3.3. The Diversity of Flora family patterns in Core zone area of Thiru.C.Rengaraj

Table No: 3.2. Flora in Buffer Zone of Thiru.C.Rengaraj, Rough stone quarry

S.No.	English Name	Vernacular Name	Scientific Name	Family Name	Resource use type *(E,M,EM)
Trees					
1.	Mango	Manga	*Mangifera indica*	Anacardiaceae	E
2.	Blue gum	Thayala maram	*Eucalyptus*	Myrtaceae	M
3.	Indian ash tree	Odiya maram	*Lannea coromandelica*	Anacardiaceae	E
4.	Neem	Vembu	*Azadirachta indica*	Meliaceae	M
5.	Tamarind	Puliyamaram	*Tamarindus indica*	Legumes	EM
6.	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae	E
7.	Bamboo	Moonghil	*Bambusa bambo*	Poaceae	E
8.	Indian almond	Padam maram	*Terminalia catappa*	Combretaceae	EM
9.	Indian ash tree	Odiya maram	***Lannea coromandelica***	Anacardiaceae	E
10.	Curry leaves	Karuveppali	*Murraya koenigii*	Rutaceae	EM
11.	Lemon	Ezhumuchaipalam	*Citrus lemon*	Rutaceae	EM
12.	Bidi leaf tree	Thiruvathi Plant	*Bauhinia racemosa*	Fabaceae	EM
13.	Peepal	Arasanmaram	*Ficus religiosa*	Moraceae	M
14.	Custard apple	Seethapazham	*Annona reticulata*	Annonaceae	E
15.	Flamboyant	Cemmayir-konrai	*Delonix regia*	Fabaceae	E
16.	Teak	Thekku	*Tectona grandis*	Verbenaceae	E
17.	Indian gooseberry	Nelli	*Emblica officinalis*	Phyllanthaceae	EM
18.	Henna	Marudaani	*Lawsonia inermis*	Lythraceae	EM
19.	Pomegranate	Mathulai	*Punica granatum*	Lythraceae	EM
20.	Banyan tree	Alamaram	*Ficus benghalensis*	Moraceae	E
21.	Chinese chaste tree	Nochi	*Vitex negundo*	Verbenaceae	E
22.	Millettia pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae	E
23.	Coconut	Thennai maram	*Cocos nucifera*	Arecaceae	EM
24.	Guava	Koyya	*Psidium guajava*	Myrtaceae	EM
25.	River tamarind	Savundal maram	*leucaena leucocephala*	Fabaceae	E
26.	Portia tree	Poovarasan	*Thespesia populnea*	Malvaceae	E
27.	Drumstick tree	Murunga maram	*Moringa oleifera*	Moringaceae	EM
28.	Mesquite	Mullu maram	*Prosopis juliflora*	Fabaceae	M
29.	Papaya	Pappali maram	*Carica papaya L*	Caricaceae	EM
30.	White Bark Acacia	Vela maram	*Vachellia leucophloea*	Fabaceae	
Shrubs					
1.	Tanner's cassia	Avaram	*Senna auriculata*	Fabaceae	M
2.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae	M

3.	Lantana	Unni chedi	*Lantana camara*	Verbenaceae	M
4.	Triangular spruge	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae	NE
5.	Night shade plan	Sundaika	*Solanum torvum*	Solanaceae	EM
6.	Indian Oleander	Arali	*Nerium indicum*	Apocynaceae	M
7.	Shoe flower	Chemparuthi	*Hibiscu rosa-sinensis*	Malvaceae	EM
8.	Yellow elder	Manjarali	*Tecoma stans*	Bignoniaceae	M
9.	Puriging nut	Kattamanakku	*Jatropha curcas*	Euphorbiaceae	EM
10.	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae	
11.	Thorn apple	Oomathai	*Datura stramonium*	Solanaceae	E
12.	Castor oil plant	Amanakku	*Ricinus communis*	Euphorbiaceae	EM
13.	Flame of the Woods	Idlipoo	*Xoracoc cinea*	Rubiaceae	M
Herbs					
1.	Eggplant	Kathrikkai	*Solanum melongena*	Solanaceae	EM
2.	Aloe barbadensis	Katrazhai	*Aloe vera*	Asphodelaceae	EM
3.	Commelina benghalensis	Kanavazha	*Commelina benghalensis*	Commelinaceae	M
4.	Coat buttons	Thatha poo	*Tridax procumbens*	Asteraceae	M
5.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae	E
6.	Chilli	Milakai	*Capsicum annuum*	Solanaceae	EM
7.	Indian Copperleaf	Kuppaimeni	*Acalypha indica*	Euphorbiaceae	M
8.	Asthma-plant	Amman pacharisi	*Euphorbia hirta*	Euphorbiaceae	M
9.	Tomato	Thakkali	*Solanum lycopersicum*	Solanaceae	EM
10.	Cleome viscosa	Nai kadugu	*Celome viscosa*	Capparidaceae	M
11.	Bindii	Nerunji mullu	*Tribulus terrestris*	Zygophyllaceae	M
12.	Prickly chaff flower	Nayuruv	*Achyranthes aspera*	Amaranthaceae	M
13.	Field beans	Avarai	*Hyacinth Beans*	Fabaceae	EM
14.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae	M
15.	Spiny amaranth	Mullu keerai	*Amaranthus spinosus*	Amaranthaceae	M
16.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae	M
17.	Ban Tulsi	Melakai poondu	*Croton bonplandianus*	Euphorbiaceae	M
18.	Tomato	Thakkali	*Solanum lycopersicum*	Solanaceae	EM
19.	Europeanblack nightshade	Manathakkali	*Solanumnigrum*	Solanaceae	EM
20.	ladies' fingers	Vendakkai	*Abelmoschus esculentus*	Malvaceae	EM
21.	Vigna mungo	Ulunthu	*Vigna mungo*	Fabaceae	EM
22.	Bright eyes	Nithiyakalyani	*Catharanthus roseus*	Apocynaceae	EM
23.	Carrot grass	Parttiniyam	*Parthenium hysterophorus*	Asteraceae	NE
24.	Indian mint	Karpura valli	*Coleus amboinicus*	Lamiaceae	EM
25.	Native gooseberry	Sodakku thakkali	*Physalis minima*	Solanaceae	M

Climber					
1.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae	M
2.	Wild jasmine	Malli	*Jasminum augustifolium*	Oleaceae	EM
3.	Betel	Vetrilai	*Piper betle*	Piperaceae	EM
4.	Pointed gourd	Kovakkai	*Trichosanthes dioica*	Cucurbitaceae	EM
5.	Wild bitter	Pavarkai	*Momordica charantia*	Cucurbitaceae	EM
6.	Bottle Guard	Sorakkai	*Lagenaria siceraria*	Cucurbitaceae	EM
7.	White pumpkin	Poosanaikkaai	*Cucurbitaceae*	Cucurbitaceae	EM
8.	Rosary Pea	Gundumani	*Abrus precatorius*	Fabaceae	M
Creeper					
1.	Nut grass	Korai	*Cyperus rotandus*	Poaceae	M
Grass					
1.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae	E
2.	Windmill grass	Chevvarakupul	*Chloris barbata*	Amaranthaceae	NE
3.	Sugarcane	Karumbu	*Saccharum*	Poaceae	E
4.	Paddy	Nellu	*Oryza sativa*	Grasses	E
Cactus					
1.	Prickly pear	Nagathali	*Opuntia dillenii*	Cactaceae	M

*E- Economical, M- Medicinal, EM- Both Economical and Medicinal, NE- Not evaluated.

(Sources: Species observation in the field study)
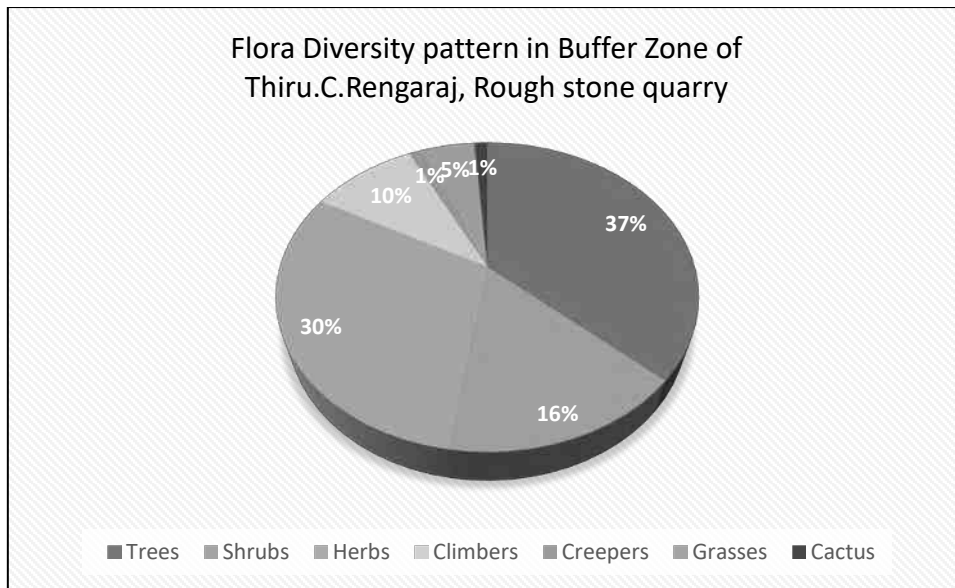
Fig No: 3.4. Flora Diversity pattern in Buffer Zone of Thiru.C.Rengaraj
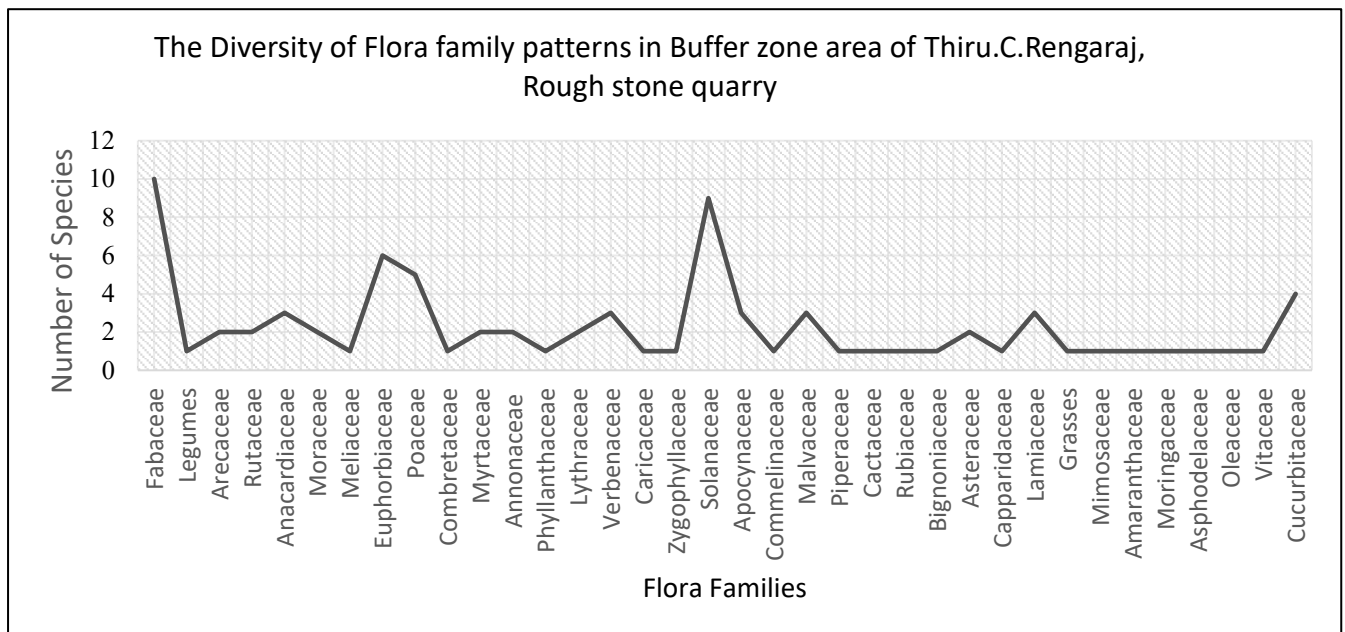
Fig No: 3.5. The Diversity of Flora family patterns in Buffer zone area of Thiru.C.Rengaraj

3.5.8. Faunal analysis:

The faunal survey has been carried out as per the methodology cited and listed out Mammals, birds, Reptiles, Amphibians, and Butterflies collected by trekking inhabiting areas, along the road, nearby village areas and agricultural fields. An inventory of the animals has been prepared separately for mammals, reptiles, and birds. The faunal species are reported as Common quail, Monitor Lizard, Common myna, Parakeet, House Crow, Rock Pigeon, Green Bee eater and Indian hare. All the listed species were compared with Red Data Book and Indian Wildlife Protection Act, 1972. There are no rare, endangered, threatened (RET) and endemic species present in the core area.

Table No: 3.3. Methodology applied during the survey of fauna

S. No	Taxa	Method of Sampling	References
1	Insects	Random walk, Opportunistic observations	Pollard (1977); Kunte (2000)
2	Reptiles	Visual encounter survey (Direct Search)	Daniel J.C (2002)
3	Amphibians	Visual encounter survey (Direct Search)	
4	Mammals	Tracks and Signs	Menon V (2014)
5	Avian	Random walk, Opportunistic observations	Grimmett R (2011); Ali S (1941)

3.5.8.1. Faunal survey

A random survey for mammals were conducted by in all major habitats and recorded the species through direct and indirect evidence. Species were identified using "A pictorial guide to the Mammals of the India" by Vivek menon (2014), Prater (1997).

For Birds, random based observation followed with point count method was applied near water bodies. Birds seen or heard 50 m radius from has been recorded during survey period. Bird surveys were carried out in dawn and desk of the field visit days. A special note on migratory status of birds were also recorded through secondary data. Birds sighted at the study area were identified using "A field guide to the birds of the Indian Sub-Continent" by Grimmett R (2011).

Reptiles were identified by direct or indirect evidence and literature gathered from the working plans of the forest department and other publications. The directly observed species are identified using the field book on Indian Reptiles and Amphibians by J.C. Daniel (2002). Snakes of India by Whitaker (2016).

Amphibians are surveyed both at aquatic and terrestrial systems searching under the logs and stones, digging through litter and soil, searching short bushes and tree hollows and under fallen barks. The books referred are Amphibians of Peninsular India by Ranjit Daniel (2004). Invertebrates such as Butterflies, Dragonflies and spiders sighted during the survey period were identified by species-specific field guides. Bugs, Beetles and other insect data were gathered from publications working plan data.

3.5.8.2. Fauna Composition in the Core Zone

A total of 21 varieties of species were observed in the Core zone of Sathiyamangalam Village, Rough stone quarry (Table No.3.7) among them numbers of Insects 8 (38%), Reptiles 3 (14%), Mammals 2 (10%) and Avian 8 (38%). A total of 21 species belonging to 18 families have been recorded from the core mining lease area. None of these species are threatened or endemic in the study area and surroundings. There is no Schedule I species and seven species are under schedule IV according to the Indian wildlife Act 1972. A total of 8 species of bird were sighted in the mining lease area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. Details of fauna in the core zone with the scientific name were mentioned in Table No. 3.4.

Table No: .3.4. Fauna in the Core zone of Thiru.C. Rengaraj, Rough stone quarry

SI. No	Common name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
Insects					
1	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
2	Colotis danae	Pieridae	*Colotis danae*	NL	LC
3	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
4	Chocolate pansy	Nymphalidae	*Junonia iphita*	NL	LC
5	Common Tiger	Nymphalidae	*Danaus genutia*	NL	NL
6	Termite	Blattodea	*Hamitermes silvestri*	NE	LC
7	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC
8	Tawny coster	Nymphalidae	*Danaus chrysippus*	Schedule IV	LC
Reptiles					
1	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
2	Common skink	Scincidae	*Mabuya carinatus*	NL	LC
3	Green vine snake	Colubridae	*Ahaetulla nasuta*	Schedule IV	NL
Mammals					
1	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	NL
2	Asian Small Mongoose	Herpestidae	*Herpestes javanicus*	Schedule (Part II)	LC
Aves					
1	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
2	House crow	Corvidae	*Corvussplendens*	NL	LC
3	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
4	Asian green bee-eater	Meropidae	*Meropsorientalis*	NL	LC
5	Rose-ringed parkeet	Psittaculidae	*Psittacula krameri*	NL	LC
6	Common quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
7	Black drongo	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
8	Cattle egret	Ardeidae	*Bubulcus ibis*	NE	LC

*NL- Not listed, LC- Least Concern
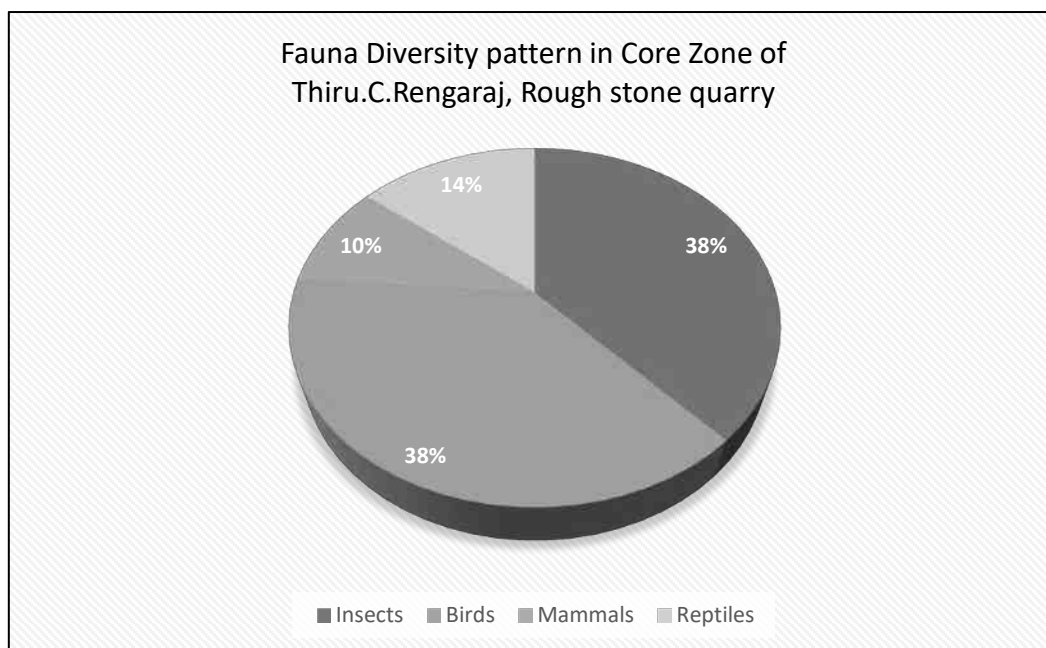
Fig No: 3.6. Fauna Diversity pattern in Core Zone of Thiru.C. Rengaraj
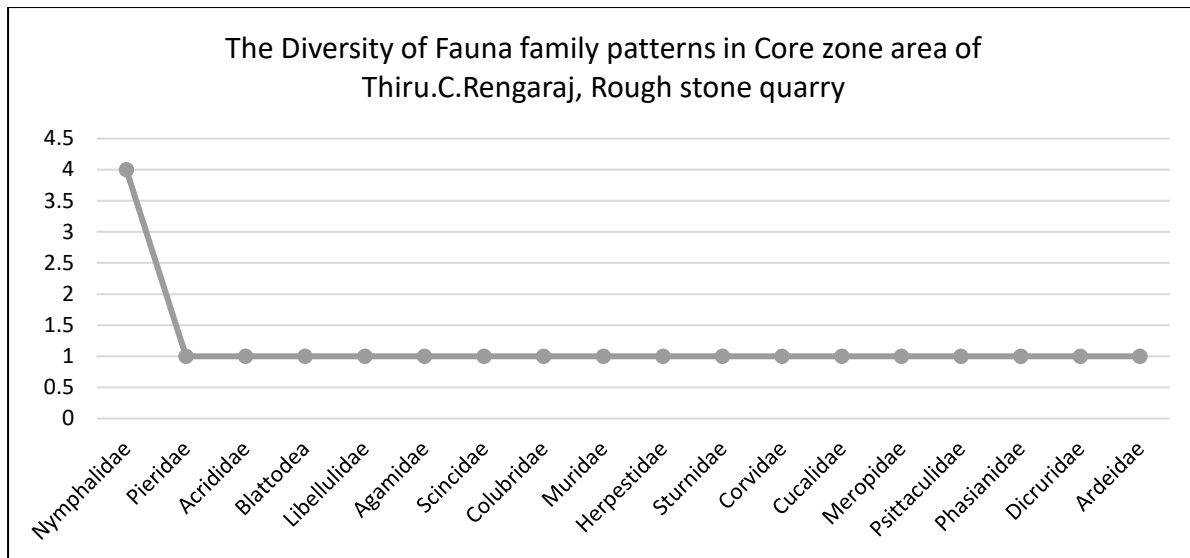
Fig No: 3.7. The Diversity of Fauna family patterns in Core zone area of Thiru.C. Rengaraj

3.5.8.3. Fauna Composition in the Buffer Zone:

As the animals, especially vertebrates move from place to place in search of food, shelter, mate or other biological needs, separate lists for core and buffer areas are not feasible however, a separate list of fauna pertaining to core and buffer zone are listed separately. Though there are no reserved forest in the buffer zone. As such there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species within the core or buffer area.

There are no Sanctuaries, National Parks, Tiger Reserve or Biosphere Reserve or Elephant Corridor or other protected areas within 10 km radius from core area. It is evident from the available records, reports, and circumstantial evidence that the entire study area including the core and buffer areas were free from any endangered animals. There were no resident birds other than common bird species such as, green bee eaters, Indian rollers, Rose-ringed parkeet, Common Mynas, Black drangos, Crows, Grey Francolin.

The list of bird species recorded during field survey and literature from the study area are given in Table 3.6. The list of reptilian species recorded during field survey and literature from the study area are given in Table 3.7. The list of insect's species recorded during field survey and literature from the study area are given in Table 3.8. The list of Amphibian species recorded during field survey and literature from the study area are given in Table 3.9. It is apparent from the list that none of the species either spotted or reported is included in Schedule I of the Wildlife Protection Act. Similarly, none of them comes under the REET category.

Taxonomically a total of 46 species belonging to 36 families have been recorded from the buffer zone area. Based on habitat classification the majority of species were Insect 15 (33%), followed by birds 14 (30%), Reptiles 10 (22%), Mammals 5 (11%), and amphibians 2 (5%). There are six Schedule II species, and twenty-four species are under schedule IV according to the Indian wildlife Act 1972. A total of 14 species of bird were sighted in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. There are no impacts on nearby fauna species.

Dominant species are mostly birds and insects, and two amphibian was observed during the extensive field visit Sphaerotheca breviceps, Euphlyctis hexadactylus. The result of Buffer zone of fauna studies shows that Nymphalidae, Colubridae, and Scincidae are the main dominating species in the study area. There is no schedule I Species in the study area. A detail of fauna diversity of family's pattern is given in Fig No.3.10. There are no critically endangered, endangered, vulnerable, and endemic species were observed.

Table 3.5. List of Fauna & Their Conservation Status,
Mammals: (*directly sighted animals & Secondary data)

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1	Indian palm squirrel	Sciuridae	*Funambulus palmarum*	Schedule IV	LC
2	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	LC
3	Asian Small Mongoose	Herpestidae	*Herpestes javanicus*	Schedule (Part II)	LC
4	Indian hare	Leporidae	*Lepus nigricollis*	Schedule (Part II)	LC
5	Brown rat	Muridae	*Rattus norwegicus*	Schedule IV	LC

Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

Table 3.6. listed birds

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
2	Cattle egret	Ardeidae	*Bubulcus ibis*	NL	LC
3	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
4	House crow	Corvidae	*Corvussplendens*	NL	LC
5	Asian green bee-eater	Meropidae	*Meropsorientalis*	NL	LC
6	Small blue Kingfisher	Alcedinidae	*Alcedo atthis*	Schedule IV	LC
7	Rose-ringed parkeet	Psittaculidae	*Psittacula krameri*	NL	LC
8	Common quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
9	Small Sunbird	Nectariniidae	*Nectarinia asiatica*	Schedule IV	LC
10	Black drongo	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
11	Woodpecker bird	Picidae	*Picidae*	Schedule IV	LC
12	Two-tailed Sparrow	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
13	Grey Francolin	Phasianidae	*Francolinus pondicerianus*	Schedule IV	LC
14	Common Coot	Rallidae	*Fulica atra*	Schedule IV	LC

*Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

Table 3.7. List of Reptiles either spotted or reported from the study area.
(*indicates Direct observations & Secondary data)

1	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
2	Chameleon	Chamaelenidae	*Chameleon zeylanicus*	Sch II (Part II)	LC
3	Fan-Throated Lizard	Agamidae	*Sitanaponticeriana*	NL	LC
4	Indian wall lizard	Gekkonidae	*Hemidactylus flaviviridis*	Schedule IV	NL
5	Green vine snake	Colubridae	*Ahaetulla nasuta*	Schedule IV	NL
6	Rat snake	Colubridae	*Ptyas mucosa*	Sch II (Part II)	LC
7	Common krait	Elapid snakes	*Bungarus caeruleus*	Schedule IV	NL
8	Indian cobra	Elapid snakes	*Naja naja*	Sch II (Part II)	LC
9	Russell's viper	Viperidae	*Vipera russseli*	Sch II (Part II)	LC
10	Common skink	Scincidae	*Mabuya carinatus*	NL	LC

Table 3.8. List of insects either spotted or reported from the study area

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1	Indian honey bee	Apidae	*Apis cerana*	Schedule IV	LC
2	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
3	Termite	Blattodea	*Hamitermes silvestri*	NE	LC
4	Crimson tip	Pieridae	*Colotis danae*	NL	LC
5	Tawny coaster	Nymphalidae	*Danaus chrysippus*	Schedule IV	LC
6	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
7	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC
8	Chocolate pansy	Nymphalidae	*Junonia iphita*	NL	LC
9	Ant	Formicidae	*Camponotus Vicinus*	NL	NL
10	Common Tiger	Nymphalidae	*Danaus genutia*	Schedule IV	LC
11	Dragonfly	Gomphidae	*Ceratogomphus pictus*	Schedule IV	LC
12	Milkweed butterfly	Nymphalidae	*Danainae*	NL	LC
13	Grass yellow	Pieridae	*Eurema hecabe*	NL	LC
14	Common Indian crow	Nymphalidae	*Euploea core*	Schedule IV	LC
15	Lesser grass blue	Lycaenidae	*Zizina Otis indica*	Schedule IV	LC

Table 3.9. List of Amphibians either spotted or reported from the study area

SI. No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
1	Indian Burrowing frog	Dicroglossidae	*Sphaerotheca breviceps*	Schedule IV	LC
2	Green pond frog	Dicroglossidae	*Euphlyctis hexadactylus*	Schedule IV	LC

*Status assigned by the IUCN, where – CR – Critically Endangered; EN – Endangered; LC – Least Concern; NT – Near Threatened; VU – Vulnerable, DA – Data Deficient, NE – Not Evaluated

a.   Colotis danae

b. Zizina Otis indica

c. Acridotheres tristis

d. Catopsilia pyranthe

e. Blattodea

f. Xylocopa

g. Chocolate pansy

h. Eurema hecabe

i. Dicrurus macrocercus

j. Calotes versicolor

k. Corvussplendens

l. Acraea terpsicore

Fig No: 3.8. Species observation in the field study (Core Zone & Buffer zone)
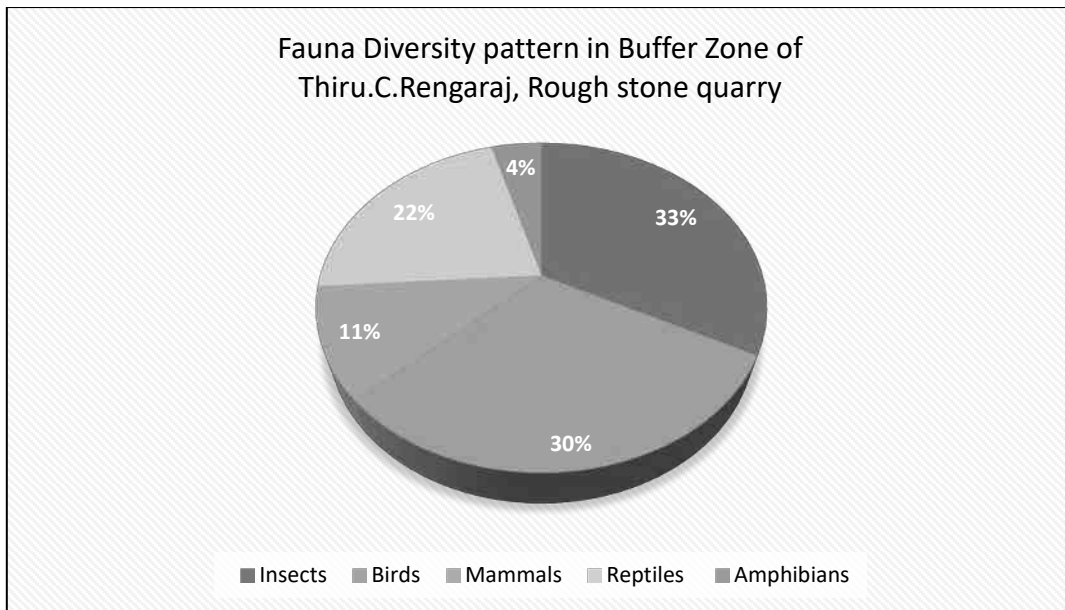
Fig No: 3.9. Fauna Diversity pattern in Buffer Zone of Thiru.C. Rengaraj
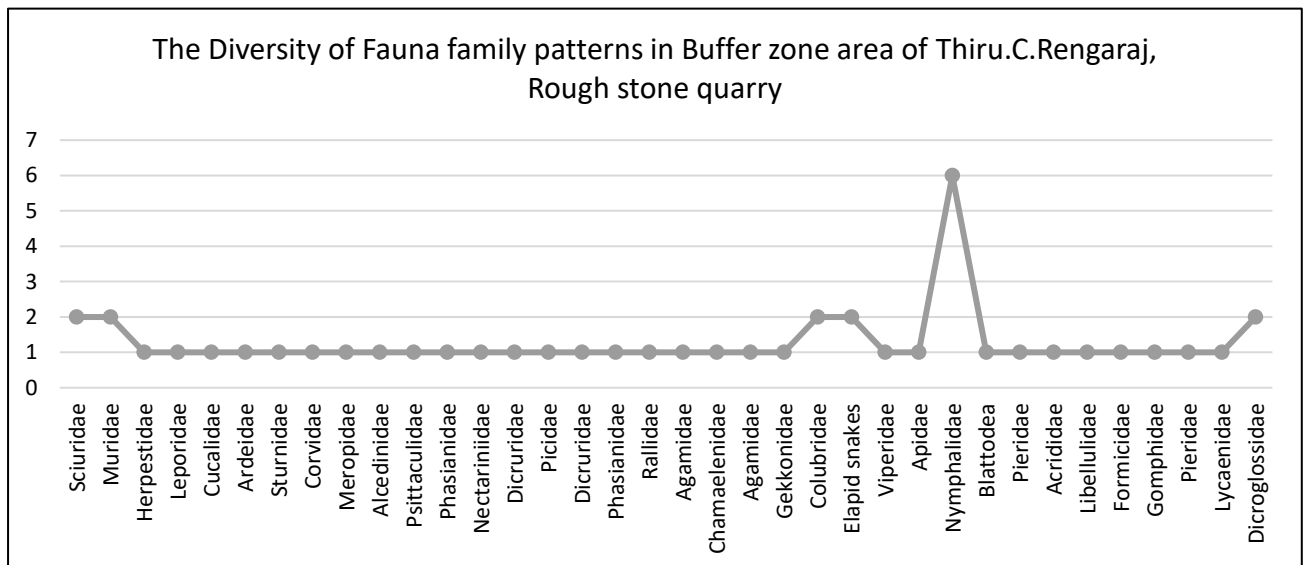
Fig No: 3.10. The Diversity of Fauna family patterns in Buffer zone area of sssssThiru.C. Rengaraj

3.5.9. Effect on Migratory corridors, Nesting and Breeding sites.

There are no migratory corridors, nesting and breeding sites within the proposed site or in the core area and study area. No need to take any mitigation measures in this connection.

3.5.9.1. Effect on REET species

From the list, no Rare or Endangered or Endemic or Threatened (REET) species or any species listed in Schedule I of the Wildlife (Protection) Act. Hence, species specific and habitat specific mitigation measures are not needed in this connection. The project site does not overlap with any of the recognized Ramsar sites.

3.5.10. Aquatic Vegetation

The field survey for assessing the aquatic vegetation was also undertaken during the study period. The list of aquatic plants observed in the study area is given in Table No 3.10.

Table No: 3.10. List of aquatic plants observed in the study area

Sl. No	Scientific name	Common Name	Vernacular Name (Tamil)	IUCN Red List of Threatened Species
1	*Nymphaea nauchali*	Blue lotus	Alli	LC
2	*Cyperus exaltatus*	Tall Flat Sedge	Koraikizhangu	LC
3	*Aponogetonnatans*	Floating laceplant	Kottikizhnagu	NA
4	*Colocassia esculenta*	Taro	Seppakizhangu	LC
5	*Carex cruciata*	Cross Grass	Koraipullu	NA
6	*Cynodon dactylon*	Scutch grass	Arugampul	LC
7	*Eichornia crassipe*	Water hyacinth	Agayatamarai	NA
8	*Nymphaea nouchali*	Blue waterlily	Nellambal	LC

*LC- Least Concern, NA-Not yet assessed

3.5.11. Conclusion

The observations and assessment of the overall ecological scenario involve details such as classification of Biogeographic zone, eco-region, habitat types and land cover, distances from natural habitats, vegetation/forest types, and sensitive ecological habitats such as Wetlands sites, Important Bird areas, migration corridors of important wildlife etc. Such baseline information provides better understanding of the situation and overall ecological importance of the area. This baseline information viewed against proposed project activities help in predicting their impacts on the wildlife and their habitats in the region. Data collected and information gathered from secondary literature on flora, fauna, protected area, natural habitats, and wildlife species etc., and consulted and discussed with local people, from the villages, herders and farmers who inhabit close to the proposed project area.

3.6 SOCIO ECONOMIC ENVIRONMENT

Socio-economic study is an essential part of environmental study. It includes demographic structure of the area, provision of basic amenities viz., housing, education, health and medical services, occupation, water supply, sanitation, communication, transportation, prevailing diseases pattern as well as feature like temples, historical monuments etc., at the baseline level. This will help in visualizing and predicting the possible impact depending upon the nature and magnitude of the project.

It is expected that the Socio-Economic Status of the area will substantially improve because of this proposed project. As the proposed project will provide direct and indirect employment and improve the infrastructural facilities in that area and, thus, improve their standard of living.

3.6.1   Objectives of the Study

The objectives of the socio-economic study are as follows:
- To study the socio-economic status of the people living in the study area of the proposed mining project.
- To assess the impact of the project on Quality of life of the people in the study area.
- To recommend Community Development measures needs to be taken up in the study Area.

3.6.2   Scope of Work
- To study the Socio-economic Environment of the area from the secondary sources;
- Data Collection & Analysis
- Prediction of project impact
- Mitigation Measures

3.6.3   District Profile

Pudukkottai is a district in Tamil Nadu, India is an administrative division of India. Pudukkottai district is further subdivided into sub-divisions/tehsils or talukas. As per the Census 2011 Pudukkottai District's total population is 1618345. Total geographical area is 4644.00 Ha. Total number of households in Pudukkottai District are 387679. Total male population in wardha is 803188 and female population is 815157. Total population under the age of six is 179688.

Total literacy rate of Pudukkottai district is 77.19 %. Sex ratio of wardha District is 1015 per 1000 male. Population Density of Pudukkottai District is 348/Ha.

3.6.4   Study area:

SATHIYAMANGALAM VILLAGE

Sathyamangalam village is situated in Teshil Kulathur, District Pudukkottai and in State of Tamil Nadu India. Village has population of 4051 as per census data of 2011, in which male population is 2055 and female population is 1996. Total geographical area of Sathyamangalam village is 1390.42 Hectares. Population density of Sathyamangalam is 3 persons per Hectares. Total number of house hold in village is 963.

Gram Panchayat name of the Sathyamangalam village is Satyamangalam. CD Block name is Annavasal and Teshil/Taluk or sub-district is Kulathur. Data Reference year is 2009 of Census 2011. Sub District HQ Name is KEERANUR and Sub District HQ Distance is 10 Km from the village. District Head Quarter name is PUDUKKOTTAI and it's distance from the village is 13KM. Nearest Town of the Sathyamangalam village is KEERANUR and nearest town distance is 10 km. Pincode of Sathyamangalam village is 622501. As per census 2011 village code of village Sathyamangalam is 639362.

TABLE 3.43: SATHIYAMANGALAM VILLAGE POPULATION FACTS

Number of Households	963
Population	4051
Male Population	2055
Female Population	1996
Children Population	430
Sex-ratio	971
Literacy	70.86%
Male Literacy	81.57%
Female Literacy	59.93%
Scheduled Tribes (ST)	2
Scheduled Caste (SC)	1160

Source: https://www.census2011.co.in/data/village/644354-Sathiyamangalam-tamil-nadu.html

TABLE 3.44: DEMOGRAPHICS POPULATION OF VILLAGE SATHIYAMANGALAM

Total Population	Male Population	Female Population
4051	2055	1996

Source: https://etrace.in/census/village/sathyamangalam-kulathur-district-pudukkottai-tamil-nadu-639362/

Sex Ratio of Sathiyamangalam Village -Census 2011

As per the Census Data 2011 there are 971 Femals per 1000 males out of 4051 total population of village. There are 903 girls per 1000 boys under 6 years of age in the village.

Literacy of Sathiyamangalam Village

Out of total population total 6156 people in Sathiyamangalam Village are literate, among them 3392 are male and 2764 are female in the village. Total literacy rate of Sathiyamangalam is 71.2%, for male literacy is 78.1% and for female literacy rate is 64.23%.

Workers profile of Sathiyamangalam Village

Total working population of Sathyamangalam is 1507 which are either main or marginal workers. Total workers in the village are 1507 out of which 1190 are male and 317 are female. Total main workers are 1440 out of which female main workers are 1143 and male main workers are 297. Total marginal workers of village are 67.

TABLE 3.45: MARDUR VILLAGE CENSUS 2011 DATA

Description	Census 2011 Data
Village Name	Sathyamangalam
Tehsil Name	Kulathur
District Name	Pudukkottai
State Name	Tamil Nadu
Total Population	4051
Total Area	1390 (Hectares)
Total No of House Holds	963
Total Male Population	2055
Total Female Population	1996
0-6 Age group Total Population	430
0-6 Age group Male Population	226
0-6 Age group Female Population	204
Total Person Literates	2566
Total Male Literates	1492
Total Male Literates	1074
Total Person Illiterates	1485
Total Male Illiterates	563
Total Male Illiterates	922
Scheduled Cast Persons	1160
Scheduled Cast Males	596
Scheduled Cast Females	564
Scheduled Tribe Persons	2
Scheduled Tribe Males	0

Source: https://etrace.in/census/village/sathyamangalam-kulathur-district-pudukkottai-tamil-nadu-639362/

TABLE 3.46: SATHIYAMANGALAM WORKING POPULATION ---CENSUS 2011

Description	Total	Male	Female
Total Workers	1507	1190	317
Main Workers	1440	1143	297
Main Workers Cultivators	136	117	19
Agriculture Labourer	1007	781	226
Household Industries	113	101	12
Other Workers	184	144	40
Marginal Workers	67	47	20
Non Working Persons	2544	865	1679

Source: https://etrace.in/census/village/sathyamangalam-kulathur-district-pudukkottai-tamil-nadu-639362/

TABLE 3.47: POPULATION DATA OF STUDY AREA

SI.No.	Village Name	NO HH	Total Population	Male	Female	Total Literate Population	Male Literate	Female Literate	Total Illiterate Population	Male Illiterate	Female Illiterate
1	Agavayal	6	30	15	15	26	12	14	4	3	1
2	Ammachattiram	658	2786	1402	1384	1854	1034	820	932	368	564
3	Ariyur	261	1194	645	549	821	503	318	373	142	231
4	Ayingudi	600	2582	1328	1254	1625	968	657	957	360	597
5	Irumbali	283	1311	684	627	925	522	403	386	162	224
6	Kedayapatti	100	405	205	200	244	137	107	161	68	93
7	Keezhakkurichi	495	2107	1051	1056	1284	735	549	823	316	507
8	Kodandaramapuram	430	1863	936	927	1117	639	478	746	297	449
9	Kolathur	1194	5049	2524	2525	3524	1888	1636	1525	636	889
10	Kudumiyamalai	614	2643	1314	1329	1765	1007	758	878	307	571
11	Kunichipatti	71	369	190	179	237	131	106	132	59	73
12	Lekkanapatti	288	1182	597	585	589	344	245	593	253	340
13	Madiyanallur	353	1552	766	786	916	509	407	636	257	379
14	Mangudi	453	1963	976	987	1218	676	542	745	300	445
15	Marayappatti	389	1757	891	866	1052	593	459	705	298	407
16	Melur	602	2534	1230	1304	1636	880	756	898	350	548
17	Muthukkadu	780	3176	1606	1570	2333	1294	1039	843	312	531
18	Narthamalai	513	2189	1133	1056	1341	764	577	848	369	479
19	Odukkur	425	1880	961	919	1117	673	444	763	288	475
20	Padipatti	252	1038	520	518	584	345	239	454	175	279
21	Panampatti	516	2292	1167	1125	1442	810	632	850	357	493
22	Panangudi	569	2335	1178	1157	1302	749	553	1033	429	604
23	Perumanadu	574	2415	1202	1213	1599	873	726	816	329	487
24	Perungudipatti	129	504	260	244	310	173	137	194	87	107
25	Perunijinai	223	919	448	471	544	306	238	375	142	233
26	Pudur	670	2937	1453	1484	1528	873	655	1409	580	829

27	Pulvayal	535	2216	1069	1147	1416	767	649	800	302	498
28	Puthambur	716	3032	1580	1452	2084	1215	869	948	365	583
29	Rapoosal	842	3808	1916	1892	2153	1269	884	1655	647	1008
30	Sanivayal	39	180	86	94	135	67	68	45	19	26
31	Sathyamangalam	963	4051	2055	1996	2566	1492	1074	1485	563	922
32	Seemanur	131	464	235	229	281	163	118	183	72	111
33	Sellukudi	111	470	239	231	279	164	115	191	75	116
34	Sembattur	640	2630	1290	1340	1820	1000	820	810	290	520
35	Siruvayal	7	29	16	13	20	12	8	9	4	5
36	Sithanavasal	410	1935	964	971	947	554	393	988	410	578
37	Tachchampatti	213	909	447	462	492	295	197	417	152	265
38	Tattampatti	58	281	147	134	188	109	79	93	38	55
39	Tayinipatti	162	698	342	356	399	218	181	299	124	175
40	Tennathirayanpatti	136	541	259	282	340	197	143	201	62	139
41	Thiruvengavasal	142	615	314	301	368	217	151	247	97	150
42	Thudaiyur	436	1859	949	910	1210	684	526	649	265	384
43	Uppiliyakkudi	553	2295	1161	1134	1551	860	691	744	301	443
44	Vagavasal	686	3060	1550	1510	2050	1149	901	1010	401	609
45	Vathanakurichi	520	2310	1128	1182	1581	849	732	729	279	450
46	Vayalogam	727	2809	1349	1460	1871	1000	871	938	349	589
47	Veerapatti	1432	6400	3100	3300	4421	2365	2056	1979	735	1244
48	Vellanjar	452	2055	1025	1030	1216	706	510	839	319	520
49	Vellanur	1454	6014	3061	2953	4095	2286	1809	1919	775	1144
50	Vengavayal	201	854	434	420	553	295	258	301	139	162
51	Vettukkadu	534	2383	1194	1189	1329	762	567	1054	432	622
52	Vilathuppatti	1165	4528	2209	2319	2933	1636	1297	1595	573	1022

Source: www.censusindia.gov.in - Tamilnadu Census of India – 2011

TABLE 3.48: WORKERS PROFILE OF STUDY AREA

SI.No.	Village Name	Total Workers Population	Male Workers	Female Workers	Total Main Workers	Main Workers Male	Main Workers Female	Main Cultivation Workers	Main Agriculture Workers	Main Other Workers	Non Worker Population
1	Agavayal	7	6	1	7	6	1	7	0	0	23
2	Ammachattiram	1675	862	813	1666	860	806	278	969	360	1111
3	Ariyur	435	295	140	419	286	133	131	146	131	759
4	Ayingudi	1607	867	740	667	474	193	237	229	177	975
5	Irumbali	569	442	127	391	341	50	116	73	191	742
6	Kedayapatti	181	113	68	181	113	68	103	40	38	224
7	Keezhakkurichi	1067	687	380	795	577	218	324	325	136	1040
8	Kodandaramapuram	777	609	168	511	446	65	240	43	226	1086
9	Kolathur	2347	1468	879	1589	1099	490	366	341	858	2702
10	Kudumiyamalai	1416	844	572	1317	825	492	229	800	277	1227
11	Kunichipatti	214	115	99	214	115	99	80	120	14	155
12	Lekkanapatti	653	341	312	595	338	257	86	435	68	529
13	Madiyanallur	847	473	374	844	471	373	135	608	99	705
14	Mangudi	813	538	275	558	500	58	45	284	213	1150
15	Marayappatti	990	555	435	819	472	347	604	141	74	767
16	Melur	1110	679	431	1099	677	422	479	278	315	1424
17	Muthukkadu	1397	952	445	1304	920	384	205	470	608	1779
18	Narthamalai	1195	689	506	667	493	174	128	179	343	994
19	Odukkur	1086	626	460	1045	603	442	831	108	106	794
20	Padipatti	610	315	295	599	307	292	106	456	37	428
21	Panampatti	1039	658	381	990	633	357	266	381	299	1253
22	Panangudi	1459	762	697	1296	714	582	313	590	385	876
23	Perumanadu	1245	715	530	1044	644	400	482	316	238	1170
24	Perungudipatti	320	163	157	313	159	154	104	180	29	184
25	Perunijinai	468	261	207	388	248	140	80	141	145	451
26	Pudur	1527	880	647	1368	824	544	114	1083	170	1410

27	Pulvayal	1093	650	443	787	514	273	112	352	278	1123
28	Puthambur	1435	916	519	1295	869	426	407	511	360	1597
29	Rapoosal	1910	1090	820	1430	867	563	212	852	362	1898
30	Sanivayal	52	41	11	20	17	3	5	2	12	128
31	Sathyamangalam	1507	1190	317	1440	1143	297	136	1007	184	2544
32	Seemanur	288	148	140	175	146	29	79	70	26	176
33	Sellukudi	207	142	65	202	142	60	14	119	69	263
34	Sembattur	1170	733	437	1096	680	416	395	482	207	1460
35	Siruvayal	11	10	1	10	9	1	0	5	5	18
36	Sithanavasal	1047	549	498	1022	537	485	431	325	259	888
37	Tachchampatti	402	242	160	248	163	85	170	61	14	507
38	Tattampatti	151	81	70	151	81	70	3	122	26	130
39	Tayinipatti	248	183	65	234	182	52	82	84	68	450
40	Tennathirayanpatti	189	138	51	183	136	47	17	80	86	352
41	Thiruvengavasal	280	193	87	271	185	86	104	115	48	335
42	Thudaiyur	935	560	375	639	396	243	161	377	79	924
43	Uppiliyakkudi	1355	725	630	1351	724	627	323	747	244	940
44	Vagavasal	1412	859	553	1044	694	350	174	303	553	1648
45	Vathanakurichi	1142	646	496	852	536	316	554	147	122	1168
46	Vayalogam	1434	769	665	1130	673	457	231	594	282	1375
47	Veerapatti	2426	1705	721	2300	1642	658	536	853	880	3974
48	Vellanjar	1292	645	647	1257	630	627	723	355	174	763
49	Vellanur	2986	1846	1140	2278	1555	723	458	440	1346	3028
50	Vengavayal	548	288	260	295	275	20	106	139	50	306
51	Vettukkadu	1269	678	591	1213	649	564	94	846	199	1114
52	Vilathuppatti	2136	1280	856	1565	1028	537	831	262	454	2392

Source: www.censusindia.gov.in - Tamilnadu Census of India – 2011

TABLE 3.49: COMMUNICATION & TRANSPORT FACILITIES IN THE STUDY AREA

Sl.No	Village Name	PO	SPO	PTO	T	PCO	MP	IC/ CSC	PCF	BS	PBS	RS	NH	SH	MDR	BTR	GR	NWR	FP
1	Agavayal	2	2	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
2	Ammachattiram	2	1	2	1	2	1	2	2	1	1	2	1	2	1	1	1	2	1
3	Ariyur	2	2	2	1	2	1	2	2	1	1	2	2	1	1	1	1	2	1
4	Ayingudi	2	2	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
5	Irumbali	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	1	2	1
6	Kedayapatti	2	2	2	1	2	1	2	2	2	2	2	2	2	2	1	1	2	1
7	Keezhakkurichi	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
8	Kodandaramapuram	2	2	2	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
9	Kolathur	1	2	1	1	1	1	2	2	2	2	2	1	2	1	1	1	2	1
10	Kudumiyamalai	2	1	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
11	Kunichipatti	2	2	2	2	1	1	2	2	1	1	2	2	2	1	1	1	2	1
12	Lekkanapatti	2	2	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
13	Madiyanallur	2	1	2	2	2	1	2	2	1	1	2	2	2	2	1	1	2	1
14	Mangudi	1	2	1	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
15	Marayappatti	2	2	2	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
16	Melur	2	1	2	1	2	1	2	2	1	1	2	1	2	2	2	1	2	1
17	Muthukkadu	2	1	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
18	Narthamalai	2	1	2	1	2	1	2	2	1	2	2	2	2	2	1	1	2	1
19	Odukkur	2	1	2	1	2	1	2	2	2	2	2	2	2	2	1	1	2	1
20	Padipatti	2	2	2	2	2	1	2	2	1	1	2	2	2	1	1	1	2	1
21	Panampatti	2	2	2	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
22	Panangudi	2	2	2	1	2	1	2	2	1	2	2	2	1	1	1	1	2	1
23	Perumanadu	2	1	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
24	Perungudipatti	2	2	2	1	2	1	1	2	1	1	2	2	2	2	1	1	2	1
25	Perunijinai	2	1	2	1	1	1	2	2	1	1	2	2	1	1	1	1	2	1
26	Pudur	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
27	Pulvayal	2	1	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
28	Puthambur	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1

		PO	MP	RS	GR	SPO	IC/CSC	NH	NWR	PTO	PCF	SH	FP	T	BS	MDR	PCO	PBS	BTR
29	Rapoosal	2	1	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
30	Sanivayal	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	1	2	1
31	Sathyamangalam	2	1	2	1	1	1	2	2	1	1	2	1	2	1	1	1	2	1
32	Seemanur	2	2	2	1	2	1	2	2	2	2	2	2	2	2	1	1	2	1
33	Sellukudi	2	2	2	2	2	1	2	2	1	1	2	2	2	2	1	1	2	1
34	Sembattur	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
35	Siruvayal	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	1	2	1
36	Sithanavasal	2	1	2	1	2	1	2	2	2	2	2	2	2	2	1	1	2	1
37	Tachchampatti	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
38	Tattampatti	2	2	2	1	2	1	2	2	2	2	2	2	2	1	1	1	2	1
39	Tayinipatti	2	2	2	1	2	1	1	2	1	1	2	2	2	1	1	1	2	1
40	Tennathirayanpatti	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
41	Thiruvengavasal	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
42	Thudaiyur	1	2	1	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
43	Uppiliyakkudi	2	1	2	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
44	Vagavasal	2	2	2	1	2	1	2	2	2	2	2	2	2	2	1	1	2	1
45	Vathanakurichi	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
46	Vayalogam	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
47	Veerapatti	2	1	2	1	1	1	2	2	1	1	2	2	1	1	1	1	2	1
48	Vellanjar	2	2	2	1	2	1	2	2	1	1	2	2	2	2	1	1	2	1
49	Vellanur	2	1	2	1	2	1	2	2	1	1	2	1	2	1	1	1	2	1
50	Vengavayal	2	2	2	2	2	1	2	2	1	1	2	2	2	1	2	2	2	1
51	Vettukkadu	2	2	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1
52	Vilathuppatti	2	1	2	1	1	1	2	2	1	1	2	2	2	2	1	1	2	1

Abbreviations: PO - Post Office; MP - Mobile Phone Coverage; RS - Railway Station; GR - Gravel Roads; SPO - Sub Post Office; IC / CSC - Internet Cafe/Common Service Centre; NH - National Highways; NWR - Navigate waterways River; PTO - Post & Telegraph office; PCF - Private Courier Facility; SH - State Highways; FP - Foot path; T- Telephone (Landline); BS - Public Bus Service; MDR - Major District Road; PCO - Public call office / Mobile; PBS - Private Bus Service; BTR - Black Topped (Pucca Roads). Note: 1 - Available within the village 2 - Not available

TABLE 3.50: WATER & DRAINAGE FACILITIES IN THE STUDY AREA

Sl	Village Name	TP	CW	UCW	HP	TW/BH	S	R/C	T/P/L	CD	OD	CT
1	Agavayal	2	2	1	2	2	2	2	2	2	2	2
2	Ammachattiram	1	1	1	2	1	2	2	2	1	1	2
3	Ariyur	1	2	1	1	1	2	2	2	1	2	2
4	Ayingudi	1	2	1	1	1	2	2	2	1	1	2
5	Irumbali	1	2	2	1	1	1	2	1	2	2	2
6	Kedayapatti	1	2	2	2	2	2	2	1	2	2	2
7	Keezhakkurichi	1	2	2	1	1	2	2	2	2	2	1
8	Kodandaramapuram	1	2	1	2	1	2	2	2	1	2	2
9	Kolathur	1	2	2	1	1	1	2	2	1	1	1
10	Kudumiyamalai	1	1	1	1	2	2	2	2	1	2	2
11	Kunichipatti	1	2	2	2	2	2	2	2	2	2	2
12	Lekkanapatti	1	2	2	2	2	2	2	2	2	2	2
13	Madiyanallur	1	2	2	2	2	2	2	2	1	1	2
14	Mangudi	1	2	2	2	1	2	2	1	1	1	1
15	Marayappatti	1	1	1	1	2	1	2	1	1	1	2
16	Melur	1	2	1	2	1	2	2	2	1	1	2
17	Muthukkadu	1	2	2	1	1	2	2	2	1	1	2
18	Narthamalai	1	1	1	1	1	1	2	2	1	1	2
19	Odukkur	1	2	2	1	1	2	2	2	1	2	1
20	Padipatti	2	2	1	2	1	2	2	2	2	2	2
21	Panampatti	1	2	2	1	1	1	2	1	1	1	2
22	Panangudi	1	1	1	2	1	2	2	1	1	2	1
23	Perumanadu	1	2	1	1	1	2	2	1	1	1	2
24	Perungudipatti	2	2	1	1	1	2	2	2	1	1	2
25	Perunijinai	1	2	1	2	1	1	2	2	1	2	2
26	Pudur	1	2	1	2	1	2	2	2	1	1	2
27	Pulvayal	1	2	1	1	1	2	2	1	1	1	2

28	Puthambur	1	1	1	1	1	2	2	1	1	1	2
29	Rapoosal	1	1	1	1	1	2	2	2	2	1	2
30	Sanivayal	2	2	1	1	1	2	2	2	2	2	2
31	Sathyamangalam	1	2	1	1	1	1	2	1	1	1	2
32	Seemanur	2	2	1	2	2	1	2	2	2	2	1
33	Sellukudi	1	2	2	2	2	2	2	2	2	2	2
34	Sembattur	1	1	2	1	2	2	2	1	1	1	2
35	Siruvayal	2	2	2	2	2	2	2	1	2	2	2
36	Sithanavasal	1	2	2	1	1	1	2	1	1	1	2
37	Tachchampatti	1	1	1	1	2	1	2	1	1	2	2
38	Tattampatti	1	1	2	2	2	2	2	2	1	2	2
39	Tayinipatti	2	2	1	1	2	1	2	2	1	1	2
40	Tennathirayanpatti	2	1	2	1	1	2	2	1	2	2	2
41	Thiruvengavasal	1	2	2	1	1	2	2	1	1	1	2
42	Thudaiyur	1	1	1	1	1	2	2	2	1	2	2
43	Uppiliyakkudi	1	2	1	2	1	1	2	2	1	2	2
44	Vagavasal	1	1	1	1	1	2	2	1	1	1	2
45	Vathanakurichi	1	2	1	2	2	2	2	2	1	1	2
46	Vayalogam	1	2	1	1	1	2	2	1	1	1	1
47	Veerapatti	1	2	1	1	1	2	2	1	1	1	2
48	Vellanjar	2	2	1	1	1	2	1	1	1	1	2
49	Vellanur	1	1	1	1	1	2	2	1	1	1	2
50	Vengavayal	2	2	2	2	2	2	2	2	2	2	2
51	Vettukkadu	1	2	1	1	1	2	2	2	1	1	2
52	Vilathuppatti	1	2	1	1	1	1	2	1	1	1	2

Abbreviations: T - Tap Water; R / C - River / Canal; CW - Covered Well; T/P/L - Tank / Pond / Lake; UCW - Uncovered Well; CD - Covered Drainage; HP - Hand Pump; OD - Open Drainage; TW/BH - Tube / Bore Well; CT - Community Toilet Complex for General public; S - Spring

Note – 1 - Available within the village; 2 - Not available

TABLE 3.51: OTHER FACILITIES IN THE STUDY AREA

Sl	Village Name	ATM	CB	COB	ACS	SHG	PDS	RM	AMS	NC	NC-AC	CC	SF	PL	NPS	APS	BDRO	PS
1	Agavayal	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
2	Ammachattiram	2	2	2	2	1	1	2	2	1	1	2	1	2	1	1	1	1
3	Ariyur	2	2	2	2	1	1	2	2	1	1	1	2	2	2	1	1	1
4	Ayingudi	2	2	2	2	1	1	2	2	1	1	2	2	2	1	1	2	1
5	Irumbali	2	2	2	2	1	1	2	2	1	1	2	2	1	1	1	1	1
6	Kedayapatti	2	2	2	2	1	1	2	2	1	1	2	2	2	2	2	2	1
7	Keezhakkurichi	2	2	2	2	1	1	2	2	1	1	1	1	1	1	1	1	1
8	Kodandaramapuram	2	2	2	2	1	1	2	2	1	1	2	2	2	1	1	2	1
9	Kolathur	2	2	2	2	1	1	2	2	1	1	1	1	1	1	1	1	1
10	Kudumiyamalai	2	2	2	1	1	1	2	2	1	1	2	2	1	1	1	1	1
11	Kunichipatti	2	2	2	2	1	1	2	2	1	1	2	2	2	1	2	2	1
12	Lekkanapatti	2	2	2	2	1	1	2	2	1	1	1	2	2	2	1	1	1
13	Madiyanallur	2	2	2	2	1	1	2	2	1	1	1	2	2	2	1	1	1
14	Mangudi	2	2	2	2	1	1	2	2	1	1	2	1	1	1	1	1	1
15	Marayappatti	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	2	1
16	Melur	2	2	2	2	1	1	2	2	1	1	1	1	1	1	1	2	1
17	Muthukkadu	2	2	2	2	1	1	2	2	1	1	1	1	2	1	1	1	1
18	Narthamalai	2	1	1	1	1	1	2	2	1	1	2	1	1	1	1	1	1
19	Odukkur	2	2	2	2	1	1	2	2	1	1	2	1	1	1	1	1	1
20	Padipatti	2	2	2	2	1	1	2	2	1	1	1	2	2	2	1	1	1
21	Panampatti	2	2	2	2	1	1	2	2	1	1	2	2	2	1	1	1
22	Panangudi	2	2	2	2	1	1	2	2	1	1	1	1	1	1	1	1	1
23	Perumanadu	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	1
24	Perungudipatti	2	2	2	2	1	1	2	2	1	1	1	2	2	1	1	1	1
25	Perunijinai	2	2	2	2	1	1	2	2	1	1	2	2	2	1	1	2	1
26	Pudur	2	2	2	2	1	1	2	2	1	1	2	2	2	1	1	1	1
27	Pulvayal	2	2	2	2	1	1	2	2	1	1	2	2	1	1	1	1	1

28	Puthambur	2	2	2	1	1	1	2	2	1	1	1	1	1	1	1	1	1
29	Rapoosal	2	2	2	2	1	1	2	2	1	1	2	1	1	1	1	1	1
30	Sanivayal	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	1
31	Sathyamangalam	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1
32	Seemanur	2	2	2	2	1	1	2	2	1	1	2	2	2	2	2	2	1
33	Sellukudi	2	2	2	2	1	1	2	2	1	1	1	2	2	2	1	1	1
34	Sembattur	2	2	2	1	1	1	2	2	1	1	2	2	1	1	1	1	1
35	Siruvayal	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
36	Sithanavasal	2	2	2	2	1	1	1	2	1	1	2	2	1	1	1	1	1
37	Tachchampatti	2	2	2	2	1	1	2	2	1	1	2	1	1	1	1	1	1
38	Tattampatti	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1
39	Tayinipatti	2	2	2	2	1	1	2	2	2	2	1	2	2	1	1	1	1
40	Tennathirayanpatti	2	2	2	2	1	2	2	2	1	1	2	2	2	1	1	1	1
41	Thiruvengavasal	2	2	2	1	1	1	2	2	1	1	1	2	2	1	2	1	1
42	Thudaiyur	2	2	1	2	1	1	2	2	1	1	2	2	2	1	1	1	1
43	Uppiliyakkudi	2	2	2	2	1	1	1	2	1	1	2	1	1	1	1	1	1
44	Vagavasal	2	2	2	2	1	1	2	2	1	1	2	2	2	1	1	1	1
45	Vathanakurichi	2	2	2	2	1	1	2	2	1	1	1	1	2	1	1	1	1
46	Vayalogam	2	1	2	2	1	1	2	2	1	1	2	1	1	1	1	1	1
47	Veerapatti	2	2	2	2	1	1	2	2	1	1	2	1	1	1	1	1	1
48	Vellanjar	2	2	2	2	1	1	2	2	1	1	1	1	1	1	1	1	1
49	Vellanur	2	2	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1
50	Vengavayal	2	2	2	2	1	1	2	2	1	1	2	1	2	2	2	2	1
51	Vettukkadu	2	2	2	2	1	1	2	2	1	1	1	1	1	1	1	1	1
52	Vilathuppatti	2	2	2	2	1	1	2	2	2	2	2	2	2	1	1	1	1

Abbreviations: ATM - Automatic Teller Machine; PDS - Public Distribution System (Shop); CB - Commerical Bank; RM - Regular Market; COB - Co-operative Bank; AMS - Agricultural Market Society; ACS - Agricultural Credit Societies; NC - Nutritional Centres; SHG - Self Help Group; NC-AC - Nutritional Centres - Anganwadi Centre; DBRO - Birth & Death Registration Office; PS - Power Supply　　Note – 1 - Available within the village; 2 - Not available

TABLE 3.52: EDUCATIONAL FACILITIES IN THE STUDY AREA

SI	Village Name	PPS		PS		MS		SS		SSS		DC		EC		MC		MI		PT		VTS		SSD	
		G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P
1	Agavayal	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	Ammachattiram	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2
3	Ariyur	1	2	1	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	1	2	2	2	2
4	Ayingudi	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	Irumbali	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	Kedayapatti	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7	Keezhakkurichi	1	1	1	1	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	Kodandaramapuram	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9	Kolathur	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2
10	Kudumiyamalai	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11	Kunichipatti	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	Lekkanapatti	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
13	Madiyanallur	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14	Mangudi	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
15	Marayappatti	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16	Melur	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
17	Muthukkadu	1	2	1	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	Narthamalai	1	1	1	2	1	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	Odukkur	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	Padipatti	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	Panampatti	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
22	Panangudi	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
23	Perumanadu	1	1	1	1	1	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
24	Perungudipatti	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
25	Perunijinai	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
26	Pudur	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
27	Pulvayal	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

28	Puthambur	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
29	Rapoosal	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
30	Sanivayal	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31	Sathyamangalam	1	2	1	2	1	2	1	2	2	2	2	2	2	1	2	2	2	1	2	1	2	2	2
32	Seemanur	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
33	Sellukudi	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
34	Sembattur	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
35	Siruvayal	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
36	Sithanavasal	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
37	Tachchampatti	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
38	Tattampatti	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
39	Tayinipatti	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
40	Tennathirayanpatti	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
41	Thiruvengavasal	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
42	Thudaiyur	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
43	Uppiliyakkudi	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
44	Vagavasal	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
45	Vathanakurichi	1	2	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
46	Vayalogam	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
47	Veerapatti	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
48	Vellanjar	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
49	Vellanur	1	2	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
50	Vengavayal	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
51	Vettukkadu	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
52	Vilathuppatti	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Abbreviations: PPS-Pre Primary School; SSS-Senior Secondary School; DC-Degree School; PT-Polytechnic; PS-Primary School; G-Government; EC-Engineering College; VTS-Vocational School /ITI; MS-Middle School; P-Private; MC-Medical College; SSD-Special School For Disabled; SS-Secondary School; MI-Management College/Institute;

Note – 1 - Available within the village; 2 - Not available

TABLE 3.53: MEDICAL FACILITIES IN THE STUDY AREA

Sl. No.	Village Name	CHC	PHC	PHSC	MCW	TBC	HA	HAM	D	VH	MHC	FWC	NGM-I/O
1	Agavayal	0	0	0	0	0	0	0	0	0	0	0	b
2	Ammachattiram	0	0	0	0	0	0	0	0	0	0	0	a
3	Ariyur	0	0	0	0	0	0	0	0	0	0	0	c
4	Ayingudi	0	0	0	0	0	0	0	0	0	0	0	c
5	Irumbali	0	0	0	0	0	0	0	0	0	0	0	b
6	Kedayapatti	0	0	0	0	0	0	0	0	0	0	0	b
7	Keezhakkurichi	0	0	0	0	0	0	0	0	1	0	0	c
8	Kodandaramapuram	0	0	0	0	0	0	0	0	0	0	0	c
9	Kolathur	0	0	1	0	0	0	0	0	0	0	0	a
10	Kudumiyamalai	0	0	0	0	0	0	0	0	1	0	0	a
11	Kunichipatti	0	0	0	0	0	0	0	0	0	0	0	b
12	Lekkanapatti	0	0	0	0	0	0	0	0	0	0	0	c
13	Madiyanallur	0	0	0	0	0	0	0	0	0	0	0	c
14	Mangudi	0	0	1	0	0	0	0	0	0	0	0	c
15	Marayappatti	0	0	0	0	0	0	0	0	0	0	0	c
16	Melur	0	0	1	0	0	0	0	0	0	0	0	b
17	Muthukkadu	0	1	1	1	1	0	0	1	1	0	1	
18	Narthamalai	0	0	1	0	0	0	0	0	1	0	0	a
19	Odukkur	1	1	1	1	1	0	0	1	1	0	1	
20	Padipatti	0	0	0	0	0	0	0	0	0	0	0	c
21	Panampatti	0	0	0	0	0	0	0	0	0	0	0	c
22	Panangudi	0	0	0	0	0	0	0	0	0	0	0	b
23	Perumanadu	0	0	1	0	0	0	0	0	1	0	0	c
24	Perungudipatti	0	0	0	0	0	0	0	0	0	0	0	c
25	Perunijinai	0	0	0	0	0	0	0	0	0	0	0	c
26	Pudur	0	0	0	0	0	0	0	0	0	0	0	b
27	Pulvayal	0	0	0	0	0	0	0	0	0	0	0	c

28	Puthambur	0	0	1	0	0	0	0	0	1	0	0	b
29	Rapoosal	0	0	1	1	0	0	0	0	1	0	0	c
30	Sanivayal	0	0	0	0	0	0	0	0	0	0	0	c
31	Sathyamangalam	0	0	1	0	0	0	0	0	0	0	0	a
32	Seemanur	0	0	0	0	0	0	0	0	0	0	0	a
33	Sellukudi	0	0	0	0	0	0	0	0	0	0	0	c
34	Sembattur	0	0	1	1	0	0	0	0	0	0	0	b
35	Siruvayal	0	0	0	0	0	0	0	0	0	0	0	c
36	Sithanavasal	0	0	0	0	0	0	0	0	0	0	0	c
37	Tachchampatti	0	0	0	0	0	0	0	0	0	0	0	b
38	Tattampatti	0	0	0	0	0	0	0	0	0	0	0	b
39	Tayinipatti	0	0	1	0	0	0	0	0	0	0	0	c
40	Tennathirayanpatti	0	0	0	0	0	0	0	0	0	0	0	c
41	Thiruvengavasal	0	0	0	0	0	0	0	0	0	0	0	c
42	Thudaiyur	0	0	0	0	0	0	0	0	0	0	0	a
43	Uppiliyakkudi	0	1	1	1	1	0	0	1	1	0	1	
44	Vagavasal	0	0	1	0	0	0	0	0	0	0	0	c
45	Vathanakurichi	0	1	1	1	1	0	0	1	1	0	1	
46	Vayalogam	0	0	1	1	0	0	0	0	1	0	0	c
47	Veerapatti	0	0	3	0	0	0	0	0	0	0	0	b
48	Vellanjar	0	0	0	0	0	0	0	0	0	0	0	b
49	Vellanur	0	0	3	0	0	0	0	0	0	0	0	a
50	Vengavayal	0	0	0	0	0	0	0	0	1	0	0	a
51	Vettukkadu	0	0	0	0	0	0	0	0	0	0	0	b
52	Vilathuppatti	0	0	1	0	0	0	0	0	0	0	0	c

Abbreviations: CHC-Community Health Centre; TBC-TB Clinic; VH- Veternity Hospital; PHC-Primary Health Centre; HA-Aallopathic Hospital; FWC-Family Welfare Centre; PHSC-Primary Health Sub Centre ; HAM-Alternative Medicine Hospital; MH-Mobile Health Clinic; MCW-Maternity and Child Welfare Centre; D-Dispensary; NGM-I/O-Non Government Medical Facilities In & Out Patient

Note – 1 - Available within the village; 2 - Not available   a-facility available at <5kms   b-facility available at>10kms

Source: www.censusindia.gov.in - Tamilnadu Census of India – 2011

3.6.6 Recommendation and Suggestion

- Awareness program to be conducted to make the population aware to get education and a better livelihood.

- Vocational training programme can be organized to make the people self - employed, particularly for women and unemployed youth.

- On the basis of qualification and skills local community may be preferred. Long term and short-term employments can be generated.

- Health care centre and ambulance facility can be provided to the population to get easy access to medical facilities. Maternity facility should be made available at the place to avoid going to distant places for treatment which involves risks. Apart from that as these areas are prone to various diseases a hospital with modern facilities should be opened on a priority basis in a central place to provide better health facilities to the villagers around the project.

- While developing an Action Plan, it is very important to identify the population who falls under the marginalized and vulnerable groups. So that special attention can be given to these groups with special provisions while making action plans.

3.6.7 Summary & Conclusion

The socio-economic study of surveyed villages gives a clear picture of its population, average household size, literacy rate and sex ratio etc. It is also found that a part of population is suffering from lack of permanent job to run their day-to-day life. Their expectation is to earn some income for their sustainability on a long-term basis. The proposed project will aim to provide preferential employment to the local people there by improving the employment opportunity in the area and in turn the social standards will improve.

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0   GENERAL

Environmental impacts both direct and indirect on various environmental attributes due to proposed mining activity will be created in the surrounding environment, during the operational and post–operational phases. The occurrence of mineral deposits, being site specific, their exploitation, often, does not allow for any choice except adoption of eco-friendly operation. The methods are required to be selected in such a manner, so as to maintain environmental equilibrium ensuring sustainable development.

In order to maintain the environmental commensuration with the mining operation, it is essential to undertake studies on the existing environmental scenario and assess the impact on different environmental components. This would help in formulating suitable management plans sustainable resource extraction.

Several scientific techniques and methodologies are available to predict impacts of physical environment. Mathematical models are the best tools to quantitatively describe the cause-and-effect relationships between sources of pollution and different components of environment. In cases where it is not possible to identify and validate a model for a particular situation, predictions have been arrived at based on logical reasoning / consultation / extrapolation.

The following parameters are of significance in the Environmental Impact Assessment and are being discussed in detail

    Land environment
    Soil environment
    Water Environment

    Air Environment

    Noise Environment

    Socio economic environment

    Biological Environment

Based on the baseline environmental status at the project site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed.

4.1 LAND ENVIRONMENT:
4.1.2 Anticipated Impact

- Permanent or temporary change on land use and land cover.
- Change in Topography: Topography of the ML area will change at the end of the life of the mine.
- Movement of heavy vehicles sometimes cause problems to agricultural land, human habitations due to dust, noise and it also causes traffic hazards.
- Due to degradation of land by pitting the aesthetic environment of the core zone may be affected.
- Earthworks during the rainy season increase the potential for soil erosion and sediment laden water entering the water ways.

If no due care is taken wash off from the exposed working area may choke the water course & can also causes the siltation of water course

4.1.2 Common Mitigation Measures

- The mining activity will be gradual confined in blocks and excavation will be undertaken progressively along with other mitigative measures like phase wise development of greenbelt etc.
- Construction of garland drains all around the quarry pits and construction of check dam at strategic location in lower elevations to prevent erosion due to surface runoff during rainfall and also to collect the storm water for various uses within the proposed area
- Green belt development along the boundary within safety zone. The small quantity of water stored in the mined-out pit will be used for greenbelt
- Thick plantation will be carried out on unutilized area, top benches of mined out pits, on safety barrier, etc.,
- At conceptual stage, the land use pattern of the quarry will be changed into Greenbelt area and temporary reservoir
- In terms of aesthetics, natural vegetation surrounding the quarry will be retained (such as in a buffer area i.e., 7.5 m safety barrier and other safety provided) so as to help minimise dust emissions.
- Proper fencing will be carried out at the conceptual stage, Security will be posted round the clock, to prevent inherent entry of the public and cattle

4.1.3 Soil Environment

The proposed project area is covered by thin layer of topsoil formation and the average thickness is about 2 m, the excavated topsoil will be dumped sold to needy customers in open market.

4.1.4 Impact on Soil Environment

Erosion and Sedimentation (Removal of protective vegetation cover; Exposure of underlying soil horizons that may be less pervious, or more erodible than the surface layers; Reduced capacity of soils to absorb rainfall; Increased energy in storm-water runoff due to concentration and velocity; and Exposure of subsurface materials which are unsuitable for vegetation establishment).

4.1.5 Common Mitigation Measures

- Run-off diversion – Garland drains will be constructed all around the project boundary to prevent surface flows from entering the quarry works areas. And will be discharged into vegetated natural drainage lines, or as distributed flow across an area stabilised against erosion.
- Sedimentation ponds - Run-off from working areas will be routed towards sedimentation ponds. These trap sediment and reduce suspended sediment loads before runoff is discharged from the quarry site. Sedimentation ponds should be designed based on runoff, retention times, and soil characteristics. There may be a need to provide a series of sedimentation ponds to achieve the desired outcome.
- Retain vegetation – Retain existing or re-plant the vegetation at the site wherever possible.
- Monitoring and maintenance – Weekly monitoring and daily maintenance of erosion control systems so that they perform as specified specially during rainy season

4.1.6 Waste Dump Management

There is no waste anticipated in this Rough Stone quarrying operation. The entire quarried out materials will be utilized (100%).

4.2 WATER ENVIRONMENT
4.2.1 Anticipated Impact

- The major sources of water pollution normally associated due to mining and allied operations are:
  - o Generation of waste water from vehicle washing.
  - o Washouts from surface exposure or working areas
  - o Domestic sewage
  - o Disturbance to drainage course in the project area
  - o Mine Pit water discharge
- Increase in sediment load during monsoon in downstream of lease area
- This being a mining project, there will be no process effluent. Waste from washing of machinery may result in discharge of Oil & grease, suspended solids.
- The sewage from soak pit may percolate to the ground water table and contaminate it.
- Surface drainage may be affected due to Mining
- Abstraction of water may lead to depletion of water table

Detail of water requirements in KLD as given below:

TABLE 4.1: WATER REQUIREMENTS

*Purpose	Quantity	Source
Dust Suppression	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	0.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.5 KLD	Water Tankers
Total	**2.0 KLD**	

* Water for drinking purpose will be brought from approved water vendors

Source: Approved Mining Plan Pre-Feasibility Report

4.2.2 Common Mitigation Measures

- Garland drain, settling tank will be constructed along the proposed mining lease area. The Garland drain will be connected to settling tank and sediments will be trapped in the settling traps and only clear water will be discharged out to the natural drainage
- Rainwater will be collected in sump in the mining pits and will be allowed to store and pumped out to surface setting tank of 15 m x 10m x 3m to remove suspended solids if any. This collected water will be judiciously used for dust suppression and such sites where dust likely to be generated and for developing green belt. The proponent will collect and judicially utilize the rainwater as part of rainwater harvesting system.
- Providing benches with inner slopes and through a system of drains and channels, allowing rain water to descent into surrounding drains, so as to minimize the effects of erosion & water logging arising out of uncontrolled descent of water.
- Reuse the water collected during storm for dust suppression and greenbelt development within the mines
- Installing interceptor traps/oil separators to remove oils and greases. Water from the tipper wash-down facility and machinery maintenance yard will pass through interceptor traps/oil separators prior to its reuse;
- Using flocculating or coagulating agents to assist in the settling of suspended solids during monsoon seasons;
- Periodic (every 6 month once) analysis of quarry pit water and ground water quality in nearby villages.
- Domestic sewage from site office & urinals/latrines provided in ML is discharged in septic tank followed by soak pits.
- Waste water discharge from mine will be treated in settling tanks before using for dust suppression and tree plantation purposes.
- De-silting will be carried out before and immediately after the monsoon season.
- Regular monitoring (every 6 month once) and analysing the quality of water in open well, bore wells and surface water

4.3 AIR ENVIRONMENT
4.3.1. Anticipated Impact

- During mining, at various stages activities such as excavation, drilling, blasting, and transportation of materials, particular matter (PM), gases such as Sulphur dioxide, oxides of Nitrogen from vehicular exhaust are the main air pollutants.
- Emissions of noxious gases due to incomplete detonation of explosive may sometimes pollute the air.
- The fugitive dust released from the mining operations may cause effect on the mine workers who are directly exposed to the fugitive dust.
- Simultaneously, the air-borne dust may travel to longer distances and settle in the villages located near the mine lease area.

4.3.1.1. Modelling of Incremental Concentration

Wind erosion of the exposed areas and the air borne particulate matter generated by quarrying operation, and transportation are mainly PM_{10} & $PM_{2.5}$ and emissions of Sulphur dioxide (SO_2) & Oxides of Nitrogen (NOx) due to excavation/loading equipment and vehicles plying on haul roads are the cause of air pollution in the project area.

Similarly, loading - unloading and transportation of Rough Stone, wind erosion of the exposed area and movement of light vehicles causes of pollution. This leads to an impact on the ambient air environment around the project area.

Anticipated incremental concentration due to this quarrying activity and net increase in emissions due to quarrying activities within 500 meters around the project area is predicted by Open Pit Source modelling using AERMOD Software.

The impact on Air Environment is due to the mining and allied activities during Land Development phase, Mining process and Transportation. The emissions of Sulphur dioxide (SO_2), Oxides of Nitrogen (NOx) due to excavation/loading equipment and vehicles plying on haul roads are marginal. Loading - unloading and transportation of Rough Stone, wind erosion of the exposed area and movement of light vehicles will be the main polluting source in the mining activities releasing Particulate Matter (PM_{10}) affecting Ambient Air of the area. Prediction of impacts on air environment has been carried out taking into consideration cumulative production three proposed quarries. Air environment and net increase in emissions by Open pit source modelling in AERMOD Software.

4.3.2.1 Emission Estimation

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.
The general equation for emissions estimation is:

$$E = A \times EF \times (1-ER/100)$$

Where:
E = emissions;
A = activity rate;
EF = emission factor, and
ER = overall emission reduction efficiency, %

The proposed mining activity includes various activities like ground preparation, excavation, handling and transport of Rough Stone. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 4-2.

TABLE 4.2: ESTIMATED EMISSION RATE FOR PM$_{10}$

Activity	Source type	Value	Unit
Drilling	Point Source	0.050793200	g/s
Blasting	Point Source	0.000081779	g/s
Mineral Loading	Point Source	0.037066773	g/s
Haul Road	Line Source	0.002484720	g/s/m
Overall Mine	Area Source	0.043164416	g/s

TABLE 4.3: ESTIMATED EMISSION RATE FOR SO$_2$

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.00015963	g/s

TABLE 4.4: ESTIMATED EMISSION RATE FOR NO$_X$

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.000004973	g/s

4.3.2 Frame work of Computation & Model details

By using the above-mentioned inputs, ground level concentrations due to the quarrying activities have been estimated to know the incremental concentration in ambient air quality and impact in the study area. The effect of air pollutants upon receptors are influenced by concentration of pollutants and their dispersion in the atmosphere. Air quality modelling is an important tool for prediction, planning and evaluation of air pollution control activities besides identifying the requirements for emission control to meet the regulatory standards and to apply mitigation measures to reduce impact caused by quarrying activities. Suspended Particulate Matter (SPM) is the major pollutant occurred during quarrying activities. The prediction included the impact of Excavation, Drilling, Blasting (Occasionally), loading and movement of vehicles during transportation and meteorological parameters such as wind speed, wind direction, temperature, rainfall, humidity and Cloud cover.

Impact was predicted over the distance of 10 km around the source to assess the impact at each receptor separately at the various locations and maximum incremental GLC value at the project site. Maximum impact of PM$_{10}$ was observed close to the source due to low to moderate wind speeds. Incremental value of PM$_{10}$ was superimposed on the base line data monitored at the proposed site to predict total GLC of PM$_{10}$ due to combined impacts

FIGURE 4.1: AERMOD TERRAIN MAP
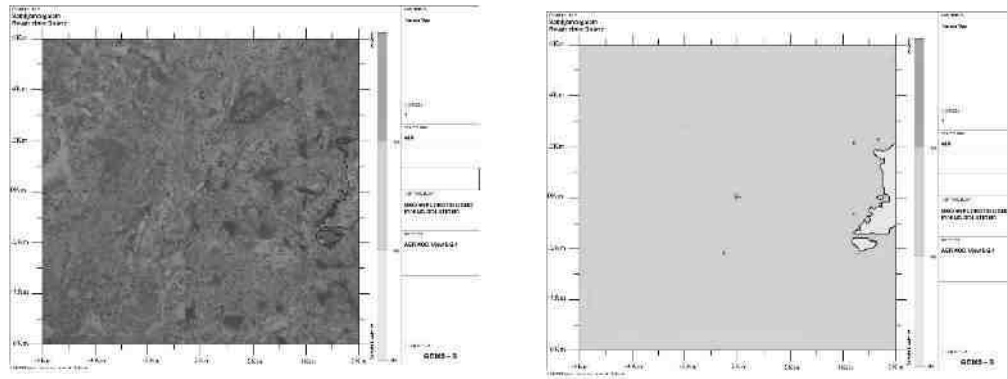
FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM$_{10}$
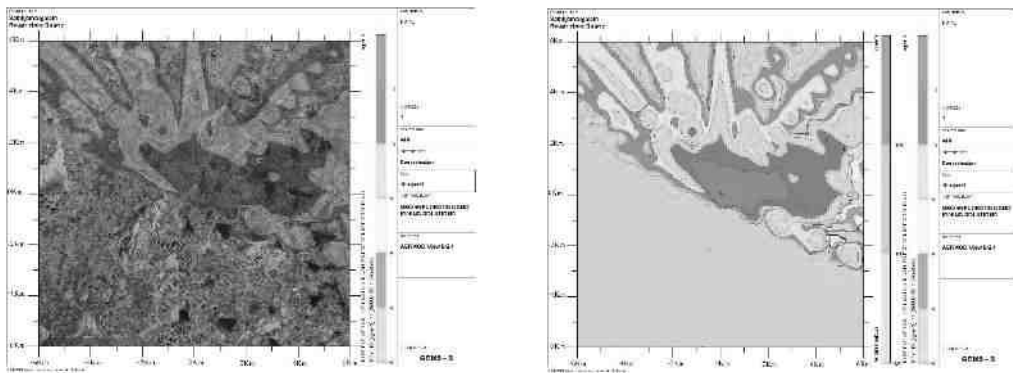
FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF SO$_2$
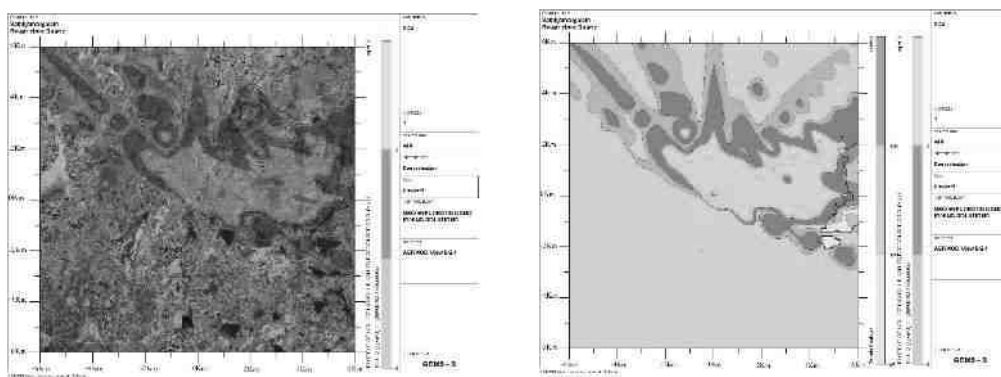
FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NO$_X$
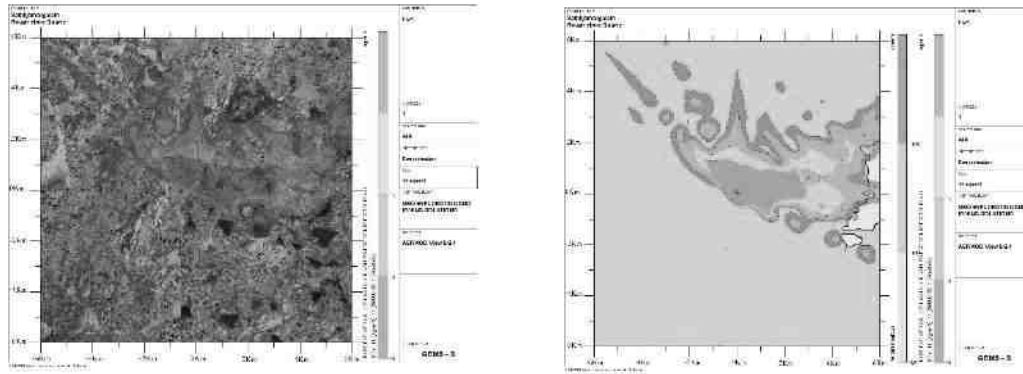
FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST
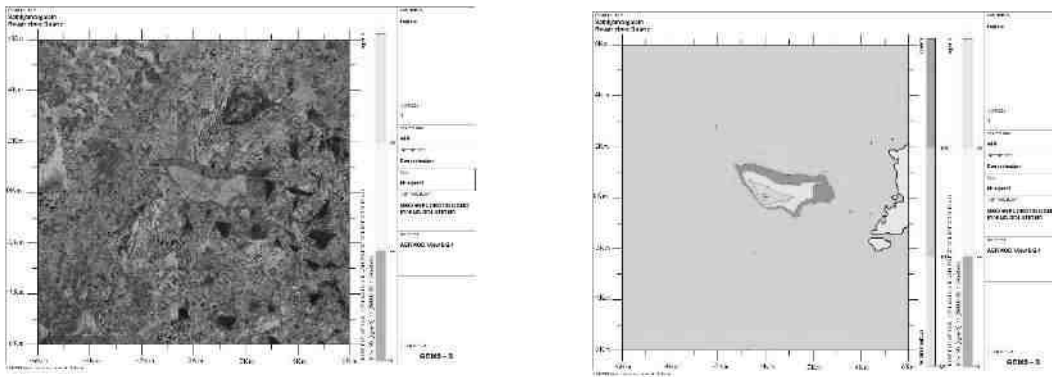
4.3.2.1 Model Results

The post project Resultant Concentrations of PM10, PM2.5, SO2& NOX (GLC) is given in Table below:

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF PM$_{10}$

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM$_{10}$ ($\mu g/m^3$)	Incremental value of PM$_{10}$ due to mining ($\mu g/m^3$)	Total PM$_{10}$ ($\mu g/m^3$) (5+6)
AAQ1	10°28'11.11"N 78°44'49.74"E	64	22	59.29	15.83	75.12
AAQ2	10°28'45.31"N 78°46'9.41"E	2509	1074	59.96	13.97	73.93
AAQ3	10°28'4.63"N 78°47'46.48"E	5478	-183	60.16	11.35	71.51
AAQ4	10°26'59.49"N 78°47'18.11"E	4611	-2189	60.26	0.54	60.8
AAQ5	10°30'8.61"N 78°44'51.39"E	115	3644	59.35	10.00	69.35
AAQ6	10°29'42.06"N 78°43'38.70"E	-2115	2826	59.31	7.99	67.30
AAQ7	10°28'29.30"N 78°43'42.09"E	-2012	581	60.12	5.02	65.14
AAQ8	10°26'59.30"N 78°44'31.46"E	-496	-2198	59.29	0	59.29

TABLE 4.6: INCREMENTAL & RESULTANT GLC OF PM$_{2.5}$

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM$_{2.5}$ ($\mu g/m^3$)	Incremental value of PM$_{2.5}$ due to mining ($\mu g/m^3$)	Total PM$_{2.5}$ ($\mu g/m^3$) (5+6)
AAQ1	10°28'11.11"N 78°44'49.74"E	64	22	30.14	7.88	38.02
AAQ2	10°28'45.31"N 78°46'9.41"E	2509	1074	29.10	7.26	36.36
AAQ3	10°28'4.63"N 78°47'46.48"E	5478	-183	30.73	6.34	37.07
AAQ4	10°26'59.49"N 78°47'18.11"E	4611	-2189	29.46	1.55	31.01
AAQ5	10°30'8.61"N 78°44'51.39"E	115	3644	29.09	4.47	33.56
AAQ6	10°29'42.06"N 78°43'38.70"E	-2115	2826	30.52	3.39	33.91
AAQ7	10°28'29.30"N 78°43'42.09"E	-2012	581	29.99	2.50	32.49
AAQ8	10°26'59.30"N 78°44'31.46"E	-496	-2198	29.72	0	29.72

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF SO$_2$

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline So$_2$ ($\mu g/m^3$)	Incremental value of So$_2$ due to mining ($\mu g/m^3$)	Total So$_2$ ($\mu g/m^3$) (5+6)
AAQ1	10°28'11.11"N 78°44'49.74"E	64	22	9.46	2.49	11.95
AAQ2	10°28'45.31"N 78°46'9.41"E	2509	1074	9.50	2.04	11.54
AAQ3	10°28'4.63"N 78°47'46.48"E	5478	-183	9.44	1.70	11.14
AAQ4	10°26'59.49"N 78°47'18.11"E	4611	-2189	9.42	0	9.42
AAQ5	10°30'8.61"N 78°44'51.39"E	115	3644	9.44	1.11	10.55
AAQ6	10°29'42.06"N 78°43'38.70"E	-2115	2826	9.5	0.66	10.16
AAQ7	10°28'29.30"N 78°43'42.09"E	-2012	581	9.47	0.12	9.59
AAQ8	10°26'59.30"N 78°44'31.46"E	-496	-2198	9.46	0	9.46

TABLE 4.8: INCREMENTAL & RESULTANT GLC OF NO$_X$

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Nox ($\mu g/m^3$)	Incremental value of Nox due to mining ($\mu g/m^3$)	Total Nox ($\mu g/m^3$) (5+6)
AAQ1	10°28'11.11"N 78°44'49.74"E	64	22	22.11	11.68	33.79
AAQ2	10°28'45.31"N 78°46'9.41"E	2509	1074	22.38	9.74	32.12
AAQ3	10°28'4.63"N 78°47'46.48"E	5478	-183	22.07	6.82	28.89
AAQ4	10°26'59.49"N 78°47'18.11"E	4611	-2189	22.02	0	22.02
AAQ5	10°30'8.61"N 78°44'51.39"E	115	3644	22.05	1.77	23.82
AAQ6	10°29'42.06"N 78°43'38.70"E	-2115	2826	22.04	0	22.04
AAQ7	10°28'29.30"N 78°43'42.09"E	-2012	581	22.14	0	22.14
AAQ8	10°26'59.30"N 78°44'31.46"E	-496	-2198	21.79	0	21.79

TABLE 4.9: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Fugitive (µg/m³)	Incremental value of Fugitive due to mining (µg/m³)	Total Fugitive (µg/m³) (5+6)
AAQ1	10°28'11.11"N 78°44'49.74"E	64	22	64.13	89	153.13
AAQ2	10°28'45.31"N 78°46'9.41"E	2509	1074	60.17	0	60.17
AAQ3	10°28'4.63"N 78°47'46.48"E	5478	-183	65.18	0	65.18
AAQ4	10°26'59.49"N 78°47'18.11"E	4611	-2189	60.49	0	60.49
AAQ5	10°30'8.61"N 78°44'51.39"E	115	3644	61.19	0	61.19
AAQ6	10°29'42.06"N 78°43'38.70"E	-2115	2826	64.85	0	64.85
AAQ7	10°28'29.30"N 78°43'42.09"E	-2012	581	64.73	0	64.73
AAQ8	10°26'59.30"N 78°44'31.46"E	-496	-2198	60.20	0	60.20

From the resultant of cumulative concentration i.e., Background + Incremental Concentration of pollutant in all the receptor locations without effective mitigation measures are still within the prescribed NAAQ limits of 100, 80 & 80 µg/m3 for PM10, SO2 & NOX respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.4. Common Mitigation Measures

Drilling – To control dust at source, wet drilling will be practiced. Where there is a scarcity of water, suitably designed dust extractor will be provided for dry drilling along with dust hood at the mouth of the drill-hole collar.

Advantages of Wet Drilling: -

- In this system dust gets suppressed close to its formation. Dust suppression become very effective and the work environment will be improved from the point of occupational comfort and health.
- Due to dust free atmosphere, the life of engine, compressor etc., will be increased.
- The life of drill bit will be increased.
- The rate of penetration of drill will be increased.
- Due to the dust free atmosphere visibility will be improved resulting in safer working conditions.

Blasting –

- Establish time of blasting to suit the local conditions and water sprinkling on blasting face
- Avoid blasting i.e., when temperature inversion is likely to occur and strong wind blows towards residential areas
- Controlled blasting includes Adoption of suitable explosive charge and short delay detonators, adequate stemming of holes at collar zone and restricting blasting to a particular time of the day i.e. at the time lunch hours, controlled charge per hole as well as charge per round of hole
- Before loading of material water will be sprayed on blasted material
- Dust mask will be provided to the workers and their use will be strictly monitored

Haul Road & Transportation –

- Water will be sprinkled on haul roads twice a day to avoid dust generation during transportation
- Transportation of material will be carried out during day time and material will be covered with taurpaulin

- The speed of tippers plying on the haul road will be limited below 20 km/hr to avoid generation of dust.
- Water sprinkling on haul roads & loading points will be carried out twice a day
- Main source of gaseous pollution will be from vehicle used for transportation of mineral; therefore, weekly maintenance of machines improves combustion process & makes reduction in the pollution.
- The un-metalled haul roads will be compacted weekly before being put into use.
- Over loading of tippers will be avoided to prevent spillage.
- It will be ensured that all transportation vehicles carry a valid PUC certificate
- Grading of haul roads and service roads to clear accumulation of loose materials

Green Belt –

- Planting of trees all along main mine haul roads and regular grading of haul roads will be practiced to prevent the generation of dust due to movement of dumpers/trucks
- Green belt of adequate width will be developed around the project areas

Occupational Health –

- Dust mask will be provided to the workers and their use will be strictly monitored
- Annual medical checkups, trainings and campaigns will be arranged to ensure awareness about importance of wearing dust masks among all mine workers & tipper drivers
- Ambient Air Quality Monitoring will be conducted six months once to assess effectiveness of mitigation measures proposed

4.4   NOISE ENVIRONMENT

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. These activities will not cause any problem to the inhabitants of this area because there is no human settlement in close proximity to the project area. Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities.

Predictions have been carried out to compute the noise level at various distances around the working pit due to these major noise-generating sources. Noise modelling has been carried out to assess the impact on surrounding ambient noise levels.

Basic phenomenon of the model is the geometric attenuation of sound. Noise at a point generates spherical waves, which are propagated outwards from the source through the air at a speed of 1,100 ft/sec, with the first wave making an ever-increasing sphere with time. As the wave spreads the intensity of noise diminishes as the fixed amount of energy is spread over an increasing surface area of the sphere. The assumption of the model is based on point source relationship i.e., for every doubling of the distance the noise levels are decreased by 6 dB (A).

For hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations at different sources using model based on first principle.

$$Lp_2 = Lp_1 - 20 \log (r_2/r_1) - Ae_{1,2}$$

Where:

Lp_1 & Lp_2 are sound levels at points located at distances r_1 & r_2 from the source.

$Ae_{1,2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$$Lp_{total} = 10 \log \{10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} + ……\}$$

4.4.1 Anticipated Impact

Attenuation due to Green Belt has been taken to be 4.9 dB (A). The inputs required for the model are:

- Source data
- Receptor data
- Attenuation factor

Source data has been computed taking into account of all the machinery and activities used in the mining process. Same has been listed in Table 4-8.

TABLE 4.10: ACTIVITY AND NOISE LEVEL PRODUCED BY MACHINERY

Sl.No.	Machinery / Activity	Impact on Environment?	Noise Produced in dB(A) at 50 ft from source*
1	Blasting	Yes	94
2	Jack Hammer	Yes	88
3	Compressor	No	81
4	Excavator	No	85
5	Tipper	No	84
Total Noise Produced			**95.8**

*50 feet from source = 15.24 meters

Source: U.S. Department of Transportation (Federal Highway Administration) – Construction Noise Handbook

The total noise to be produced by mining activity is calculated to be 95.8 dB (A). Generally, most mining operations produce noise between 100-109 dB (A). We have considered equipment and operation noise levels (max) to be approx. 109 dB (A) for nose prediction modelling.

TABLE 4.11: PREDICTED NOISE INCREMENTAL VALUES

Location ID	N1	N2	N3	N4	N5	N6	N7	N8
Maximum Monitored Value (Day) dB(A)	56.6	55.7	57.2	57.9	57.9	45.6	54.9	56.6
Incremental Value dB(A)	60.1	31.5	25.3	26.8	29.1	29.8	34.1	33.4
Total Predicted Noise level dB(A)	61.7	55.7	57.2	57.9	57.9	45.7	54.9	49.5

The incremental noise level is found within the range of 56.6 dB (A) in Core Zone and 45.6 to 57.9 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations are within permissible limits of Industrial area (core zone) & Residential area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules 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.).

4.4.2 Common Mitigation Measures
The following noise mitigation measures are proposed for control of Noise
- Usage of sharp drill bits while drilling which will help in reducing noise;
- Secondary blasting will be totally avoided and hydraulic rock breaker will be used for breaking boulders;
- Controlled blasting with proper spacing, burden, stemming and optimum charge/delay will be maintained;
- The blasting will be carried out during favourable atmospheric condition and less human activity timings by using nonelectrical initiation system;
- Proper maintenance, oiling and greasing of machines will be done every week to reduce generation of noise;
- Provision of sound insulated chambers for the workers working on machines (HEMM) producing higher levels of noise;
- Silencers / mufflers will be installed in all machineries;
- Green Belt/Plantation will be developed around the project area and along the haul roads. The plantation minimizes propagation of noise;

- Personal Protective Equipment (PPE) like ear muffs/ear plugs will be provided to the operators of HEMM and persons working near HEMM and their use will be ensured though training and awareness.
- Regular medical check–up and proper training to personnel to create awareness about adverse noise level effects

4.4.3 Ground Vibrations

Ground vibrations due to the proposed mining activities are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc., However, the major source of ground vibration from the quarry is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining lease area and may cause injury to persons or damage to the structures. Nearest habitation from the proposed project areas are listed in below table. The ground vibrations due to the blasting in the quarry are calculated using the empirical equation.

The empirical equation for assessment of peak particle velocity (PPV) is:

$$V = K \, [R/Q^{0.5}]^{-B}$$

Where –
V = peak particle velocity (mm/s)
K = site and rock factor constant
Q = maximum instantaneous charge (kg)
B = constant related to the rock and site (usually 1.6)
R = distance from charge (m)

TABLE 4.12: PREDICTED PPV VALUES DUE TO BLASTING

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in mm/s
Thiru. C. Rengaraj	6	350	0.178

FIGURE 4.6: GROUND VIBRATION PREDICTION
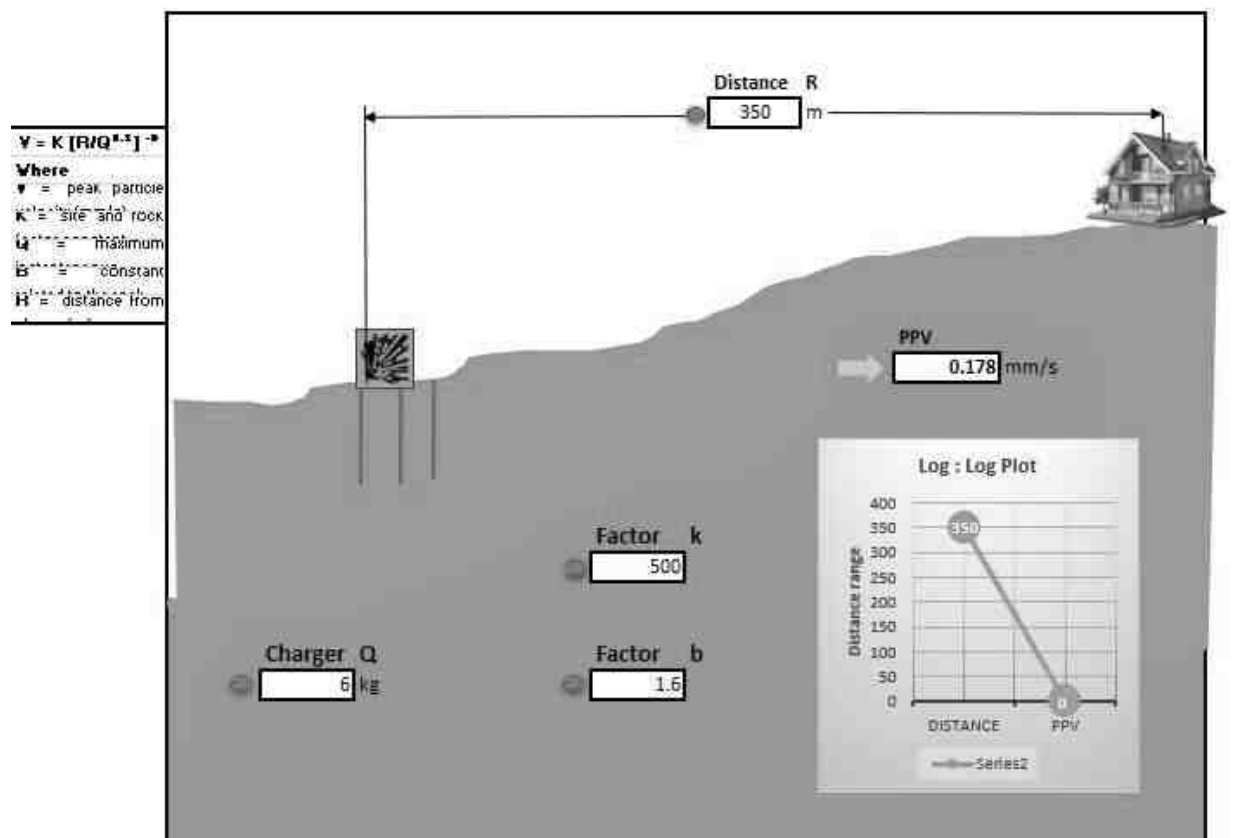
From the above graph, the charge per blast of 7 kg is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997. But the all the project proponents ensure that the charge per blast shall be less than 7 kg and carry out blasting twice or thrice a day based on the onsite conditions under the supervision of competent person employed. However, as per statutory requirement control measures will be adopted to avoid the impacts due to ground vibrations and fly rocks due to blasting.

4.4.3.1 Common Mitigation
- The blasting operations in the cluster quarries are carried out without deep hole drilling and blasting using delay detonators, which reduces the ground vibrations;
- Proper quantity of explosive, suitable stemming materials and appropriate delay system will be adopted to avoid overcharging and for safe blasting;
- Adequate safe distance from blasting will be maintained as per DGMS guidelines;
- Blasting shelter will be provided as per DGMS guidelines;
- Blasting operations will be carried out only during day time;
- The charge per delay will be minimized and preferably more number of delays will be used per blasts;
- During blasting, other activities in the immediate vicinity will be temporarily stopped;
- Drilling parameters like depth, diameter and spacing will be properly designed to give proper blast;
- A fully trained explosives blast man (Mining Mate, Mines Foreman, 2nd Class Mines Manager/ 1st Class Mines Manager) will be appointed.

- A set of shot firing rules will be drawn up and blasting shall commence outlining the detailed operating procedures that will be followed to ensure that shot firing operations on site take place without endangering the workforce or public.
- Sufficient angular stemming material will be used to confine the explosive force and minimise environmental disturbance caused by venting / misfire.
- The detonators will be connected in a predetermined sequence to ensure that only one charge is detonated at any one time and a NONEL or similar type initiation system will be used.
- The detonation delay sequence shall be designed so as to ensure that firing of the holes is in the direction of free faces so as to minimise vibration effects.
- Appropriate blasting techniques shall be adopted such that the predicted peak particle velocity shall not exceed 8 mm/s.
- Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices.

4.5   Biological Environment

Methodology of Sampling Flora and fauna studies were carried out during the **Summer season** to assess the list of terrestrial plant and animal species that occur in the core area and the buffer area up to 10 km radius from the project site. No damage is created to flora and fauna during the sampling. None of the specimens were collected as voucher specimens for the herbarium. It is basically done through field observations only.

4.5.1. Anticipated Impact on Flora

- There is no Eco Sensitive zone/ Critically polluted area/ HACA/CRZ located within 10 km radius of the area. (Kindly refer the Plate No 1A in the approved Mining plan). It is away from the proposed project site. There are no impacts due to this mining activity.
- None of the plants will be cut during the operational phase of the mine.
- There shall be negligible air emissions or effluents from the project site. During loading the truck, dust generation will be likely. This shall be a temporary effect and not anticipated to affect the surrounding vegetation significantly.
- Most of the land in the buffer area is undulating terrain with croplands, grass patches, and small shrubs. Hence, there will be no effect on the flora of the region.

4.5.2 Mitigation Measures
4.5.2.1. General Guidelines for Green Belt Development

The project site should have land to develop a greenbelt in and around the limits of the mine, along roads and another vacant area. The main objective of the green belt is to provide a barrier between the source of pollution and the surrounding areas. Although the project will not lead to any tree cutting, it is proposed to improve the greenery of the locality through plantation services. To avoid dust emissions, the mined materials will be covered with tarpaulin during transportation.

- Plants that grow fast will be preferred.
- Preference for high canopy covers plants with local varieties.
- Perennial and evergreen plants will be preferred.
- The development of the Green Belt is an important aspect for any plant because:
    a. It improves the ambient air quality by controlling Suspended Particulate Matter (SPM) in the air.
    b. It helps in noise abatement for the surrounding area.
    c. It helps in the settlement of new birds and insects within itself.
    d. It maintains the ecological balance.
    e. It increases the aesthetic value of the site.

4.5.2.2. Environmental Management Plan - Flora and Fauna

ToR No: 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 agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.

a. Afforestation

More number of trees has been observed along the approach road in the lease area, which is developed by the lease owner. The 7.5m Safety distance along the boundary has been identified to be utilized for subsequent Afforestation. However, afforestation should always be carried out in a systematic and scientific manner. Regional tree saplings in eco-friendly bags like Neem, Pongamia, Pinnata, and Casuarina will be planted along the Lease boundary and avenues as well as over non-active dumps with intervals 3m in between with the GPS Coordinates. A retaining wall will be constructed around the dumping yard. The rate of survival is expected to be 80% in this area. The preparation of green belt details is given in the approved mining plan.

4.5.2.2. Species Recommendation for Plantation granted in the district.
Following points have been considered while recommending the species for plantation:

- The natural growth of existing species and the survival rate of various species.
- Suitability of a particular plant species for a particular type of area.
- Creating biodiversity.
- Fast-growing, thick canopy copy, perennial and evergreen large leaf area.
- Efficient in absorbing pollutants without major effects on natural growth.
- The following species may be considered primary for plantations best suited for the prevailing climate condition in the area.

Table No 4.1. List of plant species proposed for Greenbelt development

S. No	Name of the plant (Botanical)	Family Name	Common Name	Habit
1	*Borassus flabellifer*	Arecaceae	Panai	T
2	*Morinda pubescens*	Rubiaceae	Nuna	T
3	*Pongamia pinnata*	Fabaceae	Pungam	T
4	*Thespesia Populnea*	Malvaceae	Puvarasu	T
5	*Syrygium cumini*	Myrtaceae	Naval	T
6	*Saraca asoca*	Fabaceae	Asoca	T
7	*Limonia acidissima*	Rutaceae	Odhiam	T
8	*Lannea coromandelica*	Anacardiaceae	Vila maram	T
9	*Cassia roxburghii*	Fabaceae	Sengondrai	T
10	*Pterocarpus marsupium*	Fabaceae	Vengai	T

4.5.3. Anticipated Impact on Fauna

- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice the scientific method of mining with a proper Environmental Management Plan including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.
- Fencing around the mine lease area to restrict the entry of stray animals.
- Green belt development will be carried out which will help in minimizing adverse impact on the flora found in the area.

4.5.3.1. Measures for protection and conservation of wildlife species

- Topsoil has a large number of seeds of native plant species in the mining area.
  Topsoil will be used for restoration and suitable surfaces for planted seedlings.
- Checks and controls the movement of vehicles in and out of the mine.
- Undertaking mitigative measures for a conducive environment to the flora and fauna in consultation with Forest Department.
- A dust suppression system will be installed within the mine and periphery of the mine.
- Plantation around the mine area will help in creating habitats for small faunal species and to create a better environment for various fauna. Creating and developing awareness for nature and wildlife in the adjoining villages.

4.5.3.2. Mitigation Measures

- A suitable plan for the conservation of Schedule-I Species have been prepared and necessary fund for implementation for the same will be made.
- All the preventive measures will be taken for the growth & development of fauna.
- Creating and developing awareness for nature and wildlife in the adjoining villages.
- The workers shall be trained to not harm any wildlife, should it come near the project site. No work shall be carried out after 6.00 pm.

4.5.4. Impact on Aquatic Biodiversity

Mining activities will not disturb the aquatic ecology as there is no effluent discharge proposed from the Rough stone quarry. and There are few seasonal water bodies located away from the applied lease area. There is no natural perennial surface water body within the mine lease area, like wetlands, rivers streams, lakes, and farmer sites. There is no impact on fish habitats and the food WEB/ food chain in the water body and Reservoir. Aquatic biodiversity is observed in the study area.

4.5.5. Impact Assessment on Biological Environment

This chapter highlights the various impacts on ecology and biodiversity due to mining activity. The major adverse impacts due to pre-mining and mining phases are loss of habitat, biodiversity, rare flora and fauna, fisheries and other aquatic life, migration of wildlife, and overall disruption of the ecology of the area. During the post-mining phase after land restoration, ecology may effectively improve. A detail of impact and assessments was mentioned in Table No.4.2.

4.5.6. Anticipated Environmental Impacts and Mitigation Measures of Thiru.C. Rengaraj, Rough stone quarry, Pudukottai District, Tamil Nadu.

Details anticipated issues for the next operation period were summarized with possible impacts and mitigation measures to meet the problem (Table No.4.2.).

Table No: 4.2. Anticipated impact of Ecology and Biodiversity in Thiru.C. Rengaraj, Rough stone quarry

S. No	Aspect Description	Likely Impacts on Ecology and Biodiversity (EB)	Impact Consequence Probability Description Justification	Significance	Mitigation Measures
			Pre-mining phase		
1	Uprooting of vegetation of lease area	Site specific loss of common floral diversity (Direct impact)	The site possesses Common floral (not tree) species. Clearance of these species will not	Less severe	No immediate action is required. However, a Greenbelt

			result in loss of flora.		/plantation will be developed on the project site and in the periphery of the project boundary, which will improve the floral and faunal diversity of the project area.
		Site specific loss of associated faunal diversity (Partial impact)	The site supports only common species, which use a wide variety of habitats of the buffer zone reserve forest area. So, there is no threat of Faunal diversity		
		Loss of Habitat (Direct impact)	Site does not for unique / critical habitat structure for unique flora or fauna.		
Mining phase					
2	Excavation of mineral using machine and labours, transportation Activities will Generate noise.	Site-specific disturbance to normal faunal movements at the site due to noise. (Partial impact)	Site does not form unique / critical habitat structure for unique flora or fauna.	Less severe	-Mining activity should not be operated after 5PM. -Excavation of dump and transportation work should stop before 7PM.
3	Vehicular movement for transportation of materials will result in the generation of dust (Particulate matter) due to haul roads and emission of Sulphur Dioxide, Nitrogen Dioxide, Carbon monoxide, etc.	Impact on Surrounding agriculture and associated fauna due to deposition of dust and emission of CO. (Indirect impact)	Impact is less as the agricultural land is far from the core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantations have been suggested Upgrade the vehicles with alternative fuels such biodiesel, methanol, and biofuel around the mining area.

Table No. 4.3. Overall Ecological impact assessments of Thiru.C. Rengaraj, Rough stone quarry, Pudukottai District, Tamil Nadu.

S.No	Attributes	Assessment
1	Impact of mining activity on agricultural land nearby the proposed project site.	Agricultural land is located away from proposed project site. There are no impacts on the agricultural land & Horticulture. Kindly refer the conclusion.
	Activities of the project affect the breeding/nesting sites of birds and animals	No breeding and nesting site was identified in the mining lease site. The fauna sighted mostly migrated from the buffer area.
2	Located near an area populated by rare or endangered species	No Endangered, Critically Endangered, or vulnerable species were sighted in the core mining lease area.
3	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	There is no Eco Sensitive zone/ Critically polluted area/ HACA/CRZ located within 10 km radius of the area.
4	The proposed project restricts access to waterholes for wildlife	'No '
5	Proposed mining project impact surface water quality that also provides water to wildlife	'No 'scheduled or threatened wildlife animals sighted regularly core in the core area.
6	Proposed mining project increase siltation that would affect nearby biodiversity areas.	Surface runoff management such as drains is constructed properly so there will be no siltation effect in the nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities.	'No'
8	The project release effluents into a water body that also supplies water to a wildlife.	No water body near to core zone so the chances of water becoming polluted is low.
9	Mining projects affect the forest-based livelihood/ any specific forest product on which local livelihood depended.	'No'
10	The project likely to affect migration routes.	'No 'migration route observed during the monitoring period.
11	The project is likely to affect the flora of an area, which have medicinal value	'No'
12	Forestland is to be diverted, has carbon high sequestration.	'No 'There was no forest land diverted.
13	The project is likely to affect wetlands, Fish breeding grounds, and marine ecology.	'No'. Wetland was not present in the near core Mining lease area. No breeding and nesting ground is present in the core mining area.

(***Source:** EIA Guidance Manual-Mining and Minerals, 2010)

4.6   SOCIO ECONOMIC
4.6.1 Anticipated Impact

- Dust generation from mining activity can have negative impact on the health of the workers and people in the nearby area.
- Approach roads can be damaged by the movement of tippers
- Increase in Employment opportunities both direct and indirect thereby increasing economic status of people of the region

4.6.2 Common Mitigation Measures

Good maintenance practices will be adopted for all machinery and equipment, which will help to avert potential noise problems.

- Green belt will be developed in and around the project site as per Central Pollution Control Board (CPCB) guidelines.
- Air pollution control measure will be taken to minimize the environmental impact within the core zone.
- For the safety of workers, personal protective appliances like hand gloves, helmets, safety shoes, goggles, aprons, nose masks and ear protecting devices will be provided as per mines act and rules.
- Benefit to the State and the Central governments through financial revenues by way of royalty, tax, duties, etc.., from this project directly and indirectly.
- From above details, the quarry operations will have highly beneficial positive impact in the area

4.7   OCCUPATIONAL HEALTH AND SAFETY

Occupational health and safety hazards occur during the operational phase of mining and primarily include the following:

- Respiratory hazards
- Noise
- Physical hazards
- Explosive storage and handling

4.7.1 Respiratory Hazards

Long-term exposure to silica dust may cause silicosis the following measures are proposed:

- Cabins of excavators and tippers will be enclosed with AC and sound proof
- Use of personal dust masks will be made compulsory

4.7.2 Noise

Workers are likely to get exposed to excessive noise levels during mining activities. The following measures are proposed for implementation

- No employee will be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection
- The use of hearing protection will be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110 dB(A)
- Ear muffs provided will be capable of reducing sound levels at the ear to at least 85 dB(A)
- Periodic medical hearing checks will be performed on workers exposed to high noise levels

4.7.3 Physical Hazards

The following measures are proposed for control of physical hazards

- Specific personnel training on work-site safety management will be taken up;
- Work site assessment will be done by rock scaling of each surface exposed to workers to prevent accidental rock falling and / or landslide, especially after blasting activities;
- Natural barriers, temporary railing, or specific danger signals will be provided along rock benches or other pit areas where work is performed at heights more than 2m from ground level;
- Maintenance of yards, roads and footpaths, providing sufficient water drainage and preventing slippery surfaces with an all-weather surface, such as coarse gravel will be taken up

4.7.4 Occupational Health Survey

All the persons will undergo pre-employment and periodic medical examination. Employees will be monitored for occupational diseases by conducting the following tests

- General physical tests
- Audiometric tests
- Full chest, X-ray, Lung function tests, Spirometric tests
- Periodic medical examination – yearly
- Lung function test – yearly, those who are exposed to dust
- Eye test

Essential medicines will be provided at the site. The medicines and other test facilities will be provided at free of cost. The first aid box will be made available at the mine for immediate treatment.

First aid training will be imparted to the selected employees regularly. The lists of first aid trained members shall be displayed at strategic places.

4.8   MINE WASTE MANAGEMENT
No waste is anticipated from any of the proposed quarries.

4.9   MINE CLOSURE
Mine closure plan is the most important environmental requirement in mining projects. The mine closure plan should cover technical, environmental, social, legal and financial aspects dealing with progressive and post closure activities. The closure operation is a continuous series of activities starting from the decommissioning of the project. Therefore, progressive mine closure plan should be specifically dealt with in the mining plan and is to be reviewed along with mining plan. As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have included most of the activities to be included in the closure plan. While formulating the closure objectives for the site, it is important to consider the existing or the pre-mining land use of the site; and how the operation will affect this activity.

The primary aim is to ensure that the following broad objectives along with the abandonment of the mine can be successfully achieved:

- To create a productive and sustainable after-use for the site, acceptable to mine owners, regulatory agencies, and the public
- To protect public health and safety of the surrounding habitation
- To minimize environmental damage
- To conserve valuable attributes and aesthetics
- To overcome adverse socio-economic impacts.

4.9.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.9.1.1 Physical Stability

All anthropogenic structures, which include mine workings, buildings, rest shelters etc., remaining after mine decommissioning should be physically stable. They should present no hazard to public health and safety as a result of failure or physical deterioration and they should continue to perform the functions for which they were designed. The design periods and factors of safety proposed should take full account of extreme events such as floods, hurricane, winds or earthquakes, etc. and other natural perpetual forces like erosion, etc.,

4.9.1.2 Chemical Stability

The solid wastes on the mine site should be chemically stable. This means that the consequences of chemical changes or conditions leading to leaching of metals, salts or organic compounds should not endanger public health and

safety nor result in the deterioration of environmental attributes. If the pollutant discharge likely to cause adverse impacts is predicted in advance, appropriate mitigation measures like settling of suspended solids or passive treatment to improve water quality as well as quantity, etc., could be planned. Monitoring should demonstrate that there is no adverse effect of pollutant concentrations exceeding the statutory limits for the water, soil and air qualities in the area around the closed mine.

4.9.1.3 Biological Stability

The stability of the surrounding environment is primarily dependent upon the physical and chemical characteristics of the site, whereas the biological stability of the mine site itself is closely related to rehabilitation and final land use. Nevertheless, biological stability can significantly influence physical or chemical stability by stabilizing soil cover, prevention of erosion/wash off, leaching, etc.,

A vegetation cover over the disturbed site is usually one of the main objectives of the rehabilitation programme, as vegetation cover is the best long-term method of stabilizing the site. When the major earthwork components of the rehabilitation programme have been completed, the process of establishing a stable vegetation community begins. For re-vegetation, management of soil nutrient levels is an important consideration. Additions of nutrients are useful under three situations.

- Where the nutrient level of spread topsoil is lower than material in-situ e.g. for development of social forestry
- Where it is intended to grow plants with a higher nutrient requirement than those occurring naturally e.g. planning for agriculture
- Where it is desirable to get a quick growth response from the native flora during those times when moisture is not a limiting factor e.g. development of green barriers

The Mine closure plan should be as per the approved mine plan. The mine closure is a part of approved mine plan and activities of closure shall be carried out as per the process described in mine closure plan.

5.   ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.1 INTRODUCTION

Consideration of alternatives to a project proposal is a requirement of EIA process. During the scoping process, alternatives to a proposal can be considered or refined, either directly or by reference to the key issues identified. A comparison of alternatives helps to determine the best method of achieving the project objectives with minimum environmental impacts or indicates the most environmentally friendly and cost-effective options.

5.2 FACTORS BEHIND THE SELECTION OF PROJECT SITE

Thiru. C. Rengaraj Rough Stone Quarry Project at Sathiyamangalam Village is a mining project for excavation of Rough Stone, which is site specific. The proposed mining lease areas have following advantages: -

- The mineral deposit occurs in a non-forest area.
- There is no habitation within the project area; hence no R & R issues exist.
- There is no river, stream, nallah and water bodies in the applied mine lease areas.
- Availability of skilled, semi-skilled and unskilled workers in this region.
- All the basic amenities such as medical, firefighting, education, transportation, communication and infrastructural facilities are well connected and accessible.
- The mining operations will not intersect the ground water level. Hence, no impact on ground water environment.
- Study area falls in seismic zone – III, there is no major history of landslides, earthquake, subsidence etc., recorded in the past history

5.3 ANALYSIS OF ALTERNATIVE SITE

No alternatives are suggested as all the mine sites are mineral specific

5.4 FACTORS BEHIND SELECTION OF PROPOSED TECHNOLOGY

Mechanized open cast mining operation with drilling and blasting method will be used to extract Rough Stone in the area. All the applied mining lease areas have following advantages –

- As the mineral deposition is homogeneous and batholith formation, therefore opencast method of working is preferred over underground method
- The material will be loaded with the help of excavators into dumpers / trippers and transported to the needy customers.
- Blasting and availability of drills along with controlled blasting technology gives desired fragmentation so that the mineral is handled safely and used without secondary blasting.
- Semi-skilled labours fit for quarrying operations are easily available around the nearby villages

5.5 ANALYSIS OF ALTERNATIVE TECHNOLOGY

Open cast mechanized method has been selected for these projects. This technology is having least gestation period, economically viable, safest and less labour intensive. The method has inbuilt flexibility for increasing or decreasing the production as per market condition.

6.   ENVIRONMENTAL MONITORING PROGRAMME

6.0   GENERAL

The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness or deficiency of the measures adopted and provides insight for future corrections.

The main objective of environmental monitoring is to ensure that the obtained results in respect of environmental attributes and prevailing conditions during operation stage are in conformity with the prediction during the planning stage. In case of substantial deviation from the earlier prediction of results, this forms as base data to identify the cause and suggest remedial measures. Environmental monitoring is mandatory to meet compliance of statutory provisions under the Environment (Protection) Act, 1986, relevant conditions regarding monitoring covered under EC orders issued by the SEIAA as well as the conditions set forth under the order issued by Tamil Nadu Pollution Control Board while granting CTE/CTO.

6.1   METHODOLOGY OF MONITORING MECHANISM

Implementation of EMP and periodic monitoring will be carried out by Respective Project Proponents. A comprehensive monitoring mechanism has been devised for monitoring of impacts due to proposed projects; Environmental protection measures like dust suppression, control of noise and blast vibrations, maintenance of machinery and vehicles, housekeeping in the mine premises, plantation, implementation of Environmental Management Plan and environmental clearance conditions will be monitored by the Respective Mine Management. On the other hand, implementation of area level protection measures like green belt development, environmental quality monitoring etc., are taken up by a senior executive who reports to their Mine Management.

An Environment monitoring cell (EMC) will be constituted to monitor the implementation of EMP and other environmental protection measures in all the proposed quarries.

The responsibilities of this cell will be:

- Implementation of pollution control measures
- Monitoring programme implementation
- Post-plantation care
- To check the efficiency of pollution control measures taken
- Any other activity as may be related to environment
- Seeking expert's advice when needed.

The environmental monitoring cell will co-ordinate all monitoring programs at site and data thus generated will be regularly furnished to the State regulatory agencies as compliance status reports.

The sampling and analysis report of the monitored environmental attributes will be submitted to the Tamil Nadu Pollution Control Board (TNPCB) at a frequency of half-yearly and yearly by each proposed project proponent. The half-yearly reports are submitted to Ministry of Environment and Forest, Regional Office and SEIAA as well.

The sampling and analysis of the environmental attributes will be as per the guidelines of Central Pollution Control Board (CPCB)/Ministry of Environment, Forest and Climate Change (MoEF & CC).

FIGURE 6.1: PROPOSED ENVIRONMENTAL MONITORING CELL P1 TO P6
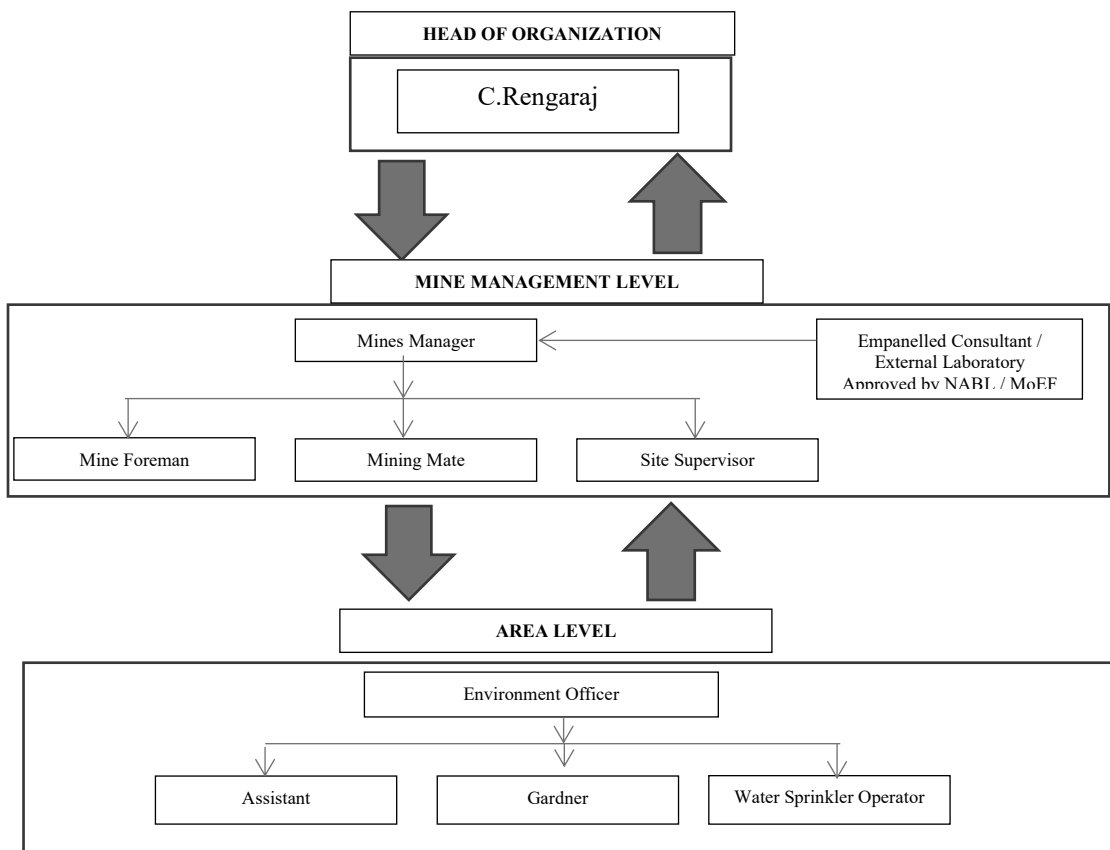
* The Environmental Monitoring Cell will be formed in the proposed project

6.2   IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES

The mitigation measures proposed in Chapter-4 will be implemented so as to reduce the impact on the environment due to the operations of the proposed project. Implementation schedule of mitigation measures is given in Table 6.1.

TABLE 6.1 IMPLEMENTATION SCHEDULE FOR PROPOSED PROJECT

Sl No.	Recommendations	Time Period	Schedule
1	Land Environment Control Measures	Before commissioning of the project	Immediately after the commencement of project
2	Soil Quality Control Measures	Before commissioning of the project	Immediately after the commencement of project
3	Water Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
4	Air Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
5	Noise Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
6	Ecological Environment	Phase wise implementation every year along with mine operations	Immediately and as project progress

6.3   MONITORING SCHEDULE AND FREQUENCY

Monitoring shall confirm that commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges, emissions and wastes, for measurement against statutory standards. Monitoring may include socio-economic interaction, through local liaison activities or even assessment of complaints.

The environmental monitoring will be conducted in the mine operations as follows:

- Air quality;
- Water and wastewater quality;
- Noise levels;
- Soil Quality; and
- Greenbelt Development

The details of monitoring is detailed in Table 6.2

TABLE 6.2: PROPOSED MONITORING SCHEDULE POST EC

S. No.	Environment Attributes	Location	Monitoring		Parameters
			Duration	Frequency	
1	Air Quality	8 Locations (2 Core & 6 Buffer)	24 hours	Once in 6 months	Fugitive Dust, PM2.5, PM10, SO2 and NOx.
2	Meteorology	At mine site before start of Air Quality Monitoring & IMD Secondary Data	Hourly / Daily	Continuous online monitoring	Wind speed, Wind direction, Temperature, Relative humidity and Rainfall
3	Water Quality Monitoring	7 Locations (2SW & 5 GW)	-	Once in 6 months	Parameters specified under IS:10500, 1993 & CPCB Norms
4	Hydrology	Water level in open wells in buffer zone around 1 km at specific wells	-	Once in 6 months	Depth in bgl
5	Noise	7 Locations (2 Core & 5 Buffer)	Hourly – 1 Day	Once in 6 months	Leq, Lmax, Lmin, Leq Day & Leq Night
6	Vibration	At the nearest habitation (in case of reporting)	–	During blasting Operation	Peak Particle Velocity
7	Soil	5 Locations (2 Core & 3 Buffer)	–	Once in six months	Physical and Chemical Characteristics
8	Greenbelt	Within the Project Area	Daily	Monthly	Maintenance

Source: Guidance of manual for mining of minerals, February 2010

6.4   BUDGETARY PROVISION FOR EMP

The cost in respect of monitoring of environmental attributes, parameter to be monitored, sampling/monitoring locations with frequency and cost provision against each proposal is shown in Table 6.3. Monitoring work will be outsourced to external laboratory approved by NABL / MoEF.

The proposed capital cost for Environmental Monitoring Programme is Rs 76,000/- and the recurring cost is Rs 76,000/- per annum for each Proposed Project

TABLE 6.3 ENVIRONMENT MONITORING BUDGET

Sl.No.	Parameter	Capital Cost	Recurring Cost per annum
1	Air Quality		
2	Meteorology	Rs. 76,000/-	Rs. 76,000/-
3	Water Quality		

4	Hydrology		
5	Soil Quality		
6	Noise Quality		
7	Vibration Study		
Total		**Rs 76,000/-**	**Rs 76,000/-**

Source: Approved Mining Plan

6.5 REPORTING SCHEDULES OF MONITORED DATA

The monitored data on air quality, water quality, noise levels and other environmental attributes will be periodically examined by the Cluster Mine Management Coordinator and Respective Head of Organization for taking necessary corrective measures. The monitoring data will be submitted to Tamil Nadu State Pollution Control Board in the Compliance to CTO Conditions & environmental audit statements every year to MoEF & CC and Half-Yearly Compliance Monitoring Reports to MoEF & CC Regional Office and SEIAA.

Periodical reports to be submitted to: -

- MoEF & CC – Half yearly status report
- TNPCB - Half yearly status report
- Department of Geology and Mining: quarterly, half yearly annual reports

Besides the Mines Manager/Agent of respective project will submit the periodical reports to –

- Director of mines safety,
- Labour enforcement officer,
- Controller of explosives as per the norms stipulated by the department.

7.   ADDITIONAL STUDIES

7.0   GENERAL

The following Additional Studies were done as per items identified by project proponent and items identified by regulatory authority. And items identified by public and other stakeholders will be incorporated after Public Hearing.

- Public Consultation
- Risk Assessment
- Disaster Management Plan
- Cumulative Impact Study
- Plastic Waste Management

7.1.   PUBLIC CONSULTATION

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the district is submitted along with this Draft EIA / EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

7.2   RISK ASSESSMENT

The methodology for the risk assessment has been based on the specific risk assessment guidance issued by the Directorate General of Mine Safety (DGMS), Dhanbad, vide Circular No.13 of 2002, dated 31st December, 2002. The DGMS risk assessment process is intended to identify existing and probable hazards in the work environment and all operations and assess the risk levels of those hazards in order to prioritize those that need immediate attention. Further, mechanisms responsible for these hazards are identified and their control measures, set to timetable are recorded along with pinpointed responsibilities.

The whole quarry operation will be carried out under the direction of a Qualified Competent Mine Manager holding certificate of competency to manage a metalliferous mine granted by the DGMS, Dhanbad for all proposed projects. Risk Assessment is all about prevention of accidents and to take necessary steps to prevent it from happening.

Factors of risks involved due to human induced activities in connection with these proposed mining & allied activities with detailed analysis of causes and control measures for the mine is given in below Table 7.1.

TABLE 7.1 RISK ASSESSMENT& CONTROL MEASURES

S. No	Risk factors	Causes of risk	Control measures
1	Accidents due to explosives and heavy mining machineries	Improper handling and unsafe working practice	All safety precautions and provisions of Mine Act, 1952, Metalliferous Mines Regulation, 1961 and Mines Rules, 1955 will be strictly followed during all mining operations; Workers will be sent to the Training in the nearby Group Vocational Training Centre Entry of unauthorized persons will be prohibited; Fire-fighting and first-aid provisions in the mine office complex and mining area; ¯ Provisions of all the safety appliances such as safety boot, helmets, goggles etc. will be made available to the employees and regular check for their use Working of quarry, as per approved plans and regularly updating the mine plans; Cleaning of mine faces on daily basis shall be daily done in order to avoid any overhang or undercut; Handling of explosives, charging and firing shall be carried out by competent persons only under the

			supervision of a Mine Manager; Maintenance and testing of all mining equipment as per manufacturer 's guidelines.
2	Drilling	Improper and unsafe practices Due to high pressure of compressed air, hoses may burst Drill Rod may break	Safe operating procedure established for drilling (SOP) will be strictly followed. Only trained operators will be deployed. No drilling shall be commenced in an area where shots have been fired until the blaster/blasting foreman has made a thorough Examination of all places, Drilling shall not be carried on simultaneously on the benches at places directly one above the other. Periodical preventive maintenance and replacement of worn-out accessories in the compressor and drill equipment as per operator manual. All drills unit shall be provided with wet drilling shall be maintained in efficient working in condition. Operator shall regularly use all the personal protective equipment.
4	Blasting	Fly rock, ground vibration, Noise and dust. Improper charging, stemming & Blasting/ fining of blast holes Vibration due to movement of vehicles	Restrict maximum charge per delay as per regulations and by optimum blast hole pattern, vibrations will be controlled within the permissible limit and blasting can be conducted safely. SOP for Charging, Stemming & Blasting/Firing of Blast Holes will be followed by blasting crew during initial stage of operation Shots are fired during daytime only. All holes charged on any one day shall be fired on the same day. The danger zone will be distinctly demarcated (by means of red flags)
5	Transportation	Potential hazards and unsafe workings contributing to accident and injuries Overloading of material While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	Before commencing work, drivers personally check the dumper/truck/tipper for oil(s), fuel and water levels, tyre inflation, general cleanliness and inspect the brakes, steering system, warning devices including automatically operated audio-visual reversing alarm, rear view mirrors, side indicator lights etc., are in good condition. Not allow any unauthorized person to ride on the vehicle nor allow any unauthorized person to operate the vehicle. Concave mirrors should be kept at all corners All vehicles should be fitted with reverse horn with one spotter at every tipping point Loading according to the vehicle capacity Periodical maintenance of vehicles as per operator manual
6	Natural calamities	Unexpected happenings	Escape Routes will be provided to prevent inundation of storm water Fire Extinguishers & Sand Buckets
7	Failure of Mine Benches and Pit Slope	Slope geometry, Geological structure	Ultimate or over all pit slope shall be below 60° and each bench height shall be 5m height.

Source: Analysed and Proposed by FAE & EC

7.3   DISASTER MANAGEMENT PLAN

Natural disasters like Earthquake, Landslides have not been recorded in the past history as the terrain is categorized under seismic zone III. The area is far away from the sea hence the disaster due to heavy floods and tsunamis are not anticipated

The Disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities.

The objective of the Disaster Management Plan is to make use of the combined resources of the mine and the outside services to achieve the following:

- Rescue and medical treatment of casualties;
- Safeguard other people;
- Minimize damage to property and the environment;
- Initially contain and ultimately bring the incident under control;
- Secure the safe rehabilitation of affected area; and
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.

In case a disaster takes place, despite preventive actions, disaster management will have to be done in line with the descriptions below. There is an organization proposed for dealing with the emergency situations and the coordination among key personnel and their team has been shown in Fig 7.1.

FIGURE 7.1: DISASTER MANAGEMENT TEAM LAYOUT
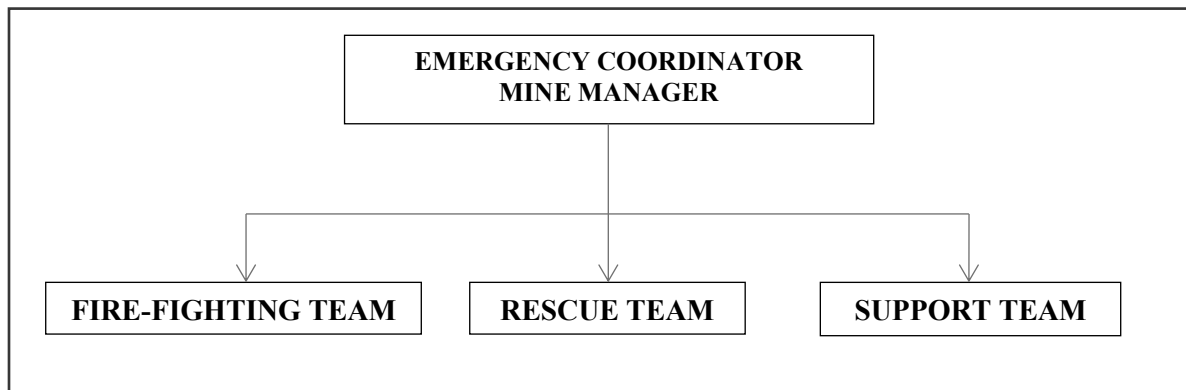
The emergency organization shall be headed by emergency coordinator who will be qualified competent mines manager. In his absence senior most people available at the mine shall be emergency coordinator till arrival of mines manager. There would be three teams for taking care of emergency situations – Fire-Fighting Team, Rescue Team and Support Team. The proposed composition of the teams is given in Table 7.2.

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION

DESIGNATION	QUALIFICATION
FIRE-FIGHTING TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Team Member	Mines Foreman
Team Member	Mining Mate
RESCUE TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Team Member/ Incident Controller (IC)	Environment Officer
Team Member	Mining Foreman
SUPPORT TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Assistant Team Leader	Environment Officer
Team Member	Mining Mate
Security Team Leader/ Emergency Security Controller	Mines Foreman

Once the mine becomes operational, the above table along with names of personnel will be prepared and made easily available to workers for respective proposed quarries. A mobile communication network and wireless shall connect Mine Emergency Control Room (MECR) to control various departments of the mine, fire station and neighbouring industrial units/mines.

Roles and responsibilities of emergency team –

(a) Emergency coordinator (EC)

The emergency coordinator shall assume absolute control of site and shall be located at MECR.

(b) Incident controller (IC)

Incident controller shall be a person who shall go to the scene of emergency and supervise the action plan to overcome or contain the emergency. Shift supervisor or Environmental Officer shall assume the charge of IC.

(c) Communication and advisory team

The advisory and communication team shall consist of heads of Mining Departments i.e., Mines Manager

(d) Roll call coordinator

The Mine Foreman shall be Roll Call Coordinator. The roll call coordinator will conduct the roll call and will evacuate the mine personnel to assembly point. His prime function shall be to account for all personnel on duty.

(e) Search and rescue team

There shall be a group of people trained and equipped to carryout rescue operation of trapped personnel. The people trained in first aid and fire-fighting shall be included in search and rescue team.

(f) Emergency security controller

Emergency Security Controller shall be senior most security person located at main gate office and directing the outside agencies e.g. fire brigade, police, doctor and media men etc.,

Emergency control procedure –

The onset of emergency, will in all probability, commence with a major fire or explosion or collapse of wall along excavation and shall be detected by various safety devices and also by members of operational staff on duty. If located by a staff member on duty, he (as per site emergency procedure of which he is adequately briefed) will go to nearest alarm call point, break glass and trigger off the alarms. He will also try his best to inform about location and nature of accident to the emergency control room. In accordance with work emergency procedure the following key activities will immediately take place to interpret and take control of emergency.

- On site fire crew led by a fireman will arrive at the site of incident with fire foam tenders and necessary equipment.
- Emergency security controller will commence his role from main gate office
- Incident controller shall rush to the site of emergency and with the help of rescue team and will start handling the emergency.
- Site main controller will arrive at MECR with members of his advisory and communication team and will assume absolute control of the site.
    - He will receive information continuously from incident controller and give decisions and directions to:
        - Incident controller
        - Mine control rooms
        - Emergency security controller

Proposed fire extinguishers at different locations –

The following type of fire extinguishers has been proposed at strategic locations within the mine.

LOCATION	
Electrical Equipment's	CO_2 type, foam type, dry chemical powder type
Fuel Storage Area	CO_2 type, foam type, dry chemical powder type, Sand bucket
Office Area	Dry chemical type, foam type

Alarm system to be followed during disaster –

On receiving the message of disaster from Site Controller, fire-fighting team, the mine control room attendant will sound siren wailing for 5 minutes. Incident controller will arrange to broadcast disaster message through public address system. On receiving the message of "Emergency Over" from Incident Controller the emergency control room attendant will give "All Clear Signal", by sounding alarm straight for 2 minutes.

The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster. In order to prevent or take care of hazard / disasters if any the following control measures have been adopted.

- All safety precautions and provisions of Metalliferous Mines Regulations (MMR), 1961 is strictly followed during all mining operations.
- Observance of all safety precautions for blasting and storage of explosives as per MMR 1961.
- Entry of unauthorized persons into mine & allied areas is completely prohibited.
- Fire-fighting and first-aid provisions in the mines office complex and mining area are provided.
- Provisions of all the safety appliances such as safety boot, helmets, goggles, dust masks, ear plugs and ear muffs etc. are made available to the employees and the use of same is strictly adhered to through regular monitoring.
- Training and refresher courses for all the employees working in hazardous premises.
- Working of mine, as per approved plans and regularly updating the mine plans.
- Cleaning of mine faces is regularly done.

- Handling of explosives, charging and blasting are carried out only by qualified persons following SOP.
- Checking and regular maintenance of garland drains and earthen bunds to avoid any inflow of surface water in the mine pit.
- Provision of high-capacity standby pumps with generator sets with enough quantity of diesel for emergency pumping especially during monsoon.
- A blasting SIREN is used at the time of blasting for audio signal.
- Before blasting and after blasting, red and green flags are displayed as visual signals.
- Warning notice boards indicating the time of blasting and NOT TO TRESPASS are displayed at prominent places.
- Regular maintenance and testing of all mining equipment were carried out as per manufacturer's guidelines.

7.4   CUMULATIVE IMPACT STUDY

For easy representation of Proposed and Existing Quarries in the Cluster are given unique codes and identifies and studied in this EIA EMP Report.

TABLE 7.4: LIST OF QUARRIES WITHIN 500 METER RADIUS

CODE	Name of the Owner	S.F. Nos	Extent	Status
PROPOSED QUARRIES				
P1	Thiru. C. Rengaraj, S/o. Chinnaiya, No. 1/133, Melamuthukadu, Cauvery Nagar Post, Kulathur Taluk, Pudukkottai District – 625 501.	S.F.Nos:217/3A, 217/20, 217/21, 217/22 & 217/24	1.34.0ha	ToR Obtained vide Lr.No. SEIAA-TN/F.No.8551/SEAC/ToR-1141/2022 Dated:08.04.2022
P2	Thiru. Bahurudeen, S/O. Sahul Hameed, No. 215, Kallar Street, Thiruvapoor, Pudukkottai	220/24B2, etc.,	1.14.0 ha	EC Granted vide Lr.No.SEIAA-TN/F.No.7731/EC.No:5002/2020 dated 18.02.2022
P3	M/s. Veeram Stones Pvt., Ltd., 952, Udaiyandipatti Village, Sathiyamangalam Post, Kulathu Taluk, Pudukkottai District.	214/5, 214/8, 214/9 and 214/2A	0.73.0	Under process in Geology Department
P4	Thiru. S. Manikandan, S/o. S.M.Sait, 51,52 Charlas Nagar, 2nd Street, Pudukkottai	220/29 & 219	0.93.5	Awaiting EC
	TOTAL		**4.14.5ha**	
EXISTING QUARRIES				
CODE	Name of the Owner	S.F. Nos	Extent	Status
E1	Thiru. B. Kajamaideen, S/o. Bahurudeen, No. 215, Kallar Street, Thiruvappur, Pudukkottai	217/1B, etc.,	1.90.0	07.09.2018 to 06.09.2023
	TOTAL		**1.90.0ha**	
EXPIRED QUARRIES				
CODE	Name of the Owner	S.F. No	Extent	Lease Period
EX1	Thiru. L. Thangadurai, S/o. Lakshman, Udaiyandipatti,	217/6, 7A	0.88.0	03.07.2007 to 02.07.2012

	Sathiyamangalam (Po) Kulathur Taluk,			
EX2	Thiru. P. Murugesan, S/o. Palani, Sithannavasal, Illuppur Taluk.	217/2a, etc.,	2.31.0	03.06.2010 to 02.06.2015
			3.19.0 ha	
TOTAL CLUSTER EXTENT			**9.23.50 ha**	

Note: - Cluster area is calculated as per MoEF & CC Notification – S.O. 2269 (E) Dated: 01.07.2016

TABLE 7.5: SALIENT FEATURES OF PROPOSAL P1

Name of the Quarry	Thiru. C. Rengaraj Rough Stone Quarry		
Toposheet No	58-J/11		
Latitude between	10°28'07.82"N to 10°28'12.86"N		
Longitude between	78°44'45.46"E to 78°44'50.48"E		
Highest Elevation	112 m AMSL		
Proposed Depth of Mining	30m bgl		
Geological Resources	Rough Stone in m³	Weathered rock m³	Topsoil m³
	3,57,660	21,044	31,380
Mineable Reserves	Rough Stone in m³	Weathered rock m³	Topsoil m³
	42,620	8,648	17,781
Year wise Production for 5 years	Rough Stone in m³	Weathered rock m³	Topsoil m³
	42,620	8,648	17,781
Existing Pit Dimension	60m (L) x 55m (W) x 17m (D) bgl		
Ultimate Pit Dimension	137m (L) x 98m (W) x 30m (D) bgl		
Water Level in the surrounds area	65 – 70m bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is exhibits plain topography. The area has gentle sloping towards eastern side. The altitude of the area is 112m (max) above mean sea level. The area is covered by 3m thickness of topsoil and 2m weathered rock. Massive charnockite is found after 3m topsoil and 2m weathered rock which is clearly inferred from the existing quarrying pits.		
Machinery proposed	Jack Hammer		2 Nos
	Compressor		1 No
	Excavator with bucket and rock breaker		1 No
	Trucks		1 No
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.		
Proposed Manpower Deployment	14 Nos		
Project Cost	Rs.26,93,000/-		
CER Cost @ 2% of Project Cost	Rs 5,00,000/-		
Nearby Water Bodies	Odai		10m Safety East
	Tank		120m NE
	Tank		400m SW
	Kuttai		370m SW
	Lake near Vellanur		4.8km East
	Lake Near Sembattur		8.4km NE
Greenbelt Development Plan	Proposed to plant 750 trees in 1300Sq.m area in the 7.5m & 10m Safety Zone and panchayat roads		

Proposed Water Requirement	2.0 KLD
Nearest Habitation	350m Southeast

TABLE 7.6: SALIENT FEATURES OF PROPOSAL "P2"

Name of the Quarry	Thiru. S. Bahurudeen Rough Stone Quarry	
Toposheet No	58-J/11	
Latitude between	10°28'02.32"N to 10°28'10.44"N	
Longitude between	78°44'39.98"E to 78°44'44.21"E	
Proposed Depth of Mining	21 m bgl	
Geological Resources	Rough Stone in m^3	Topsoil m^3
	2,25,980.64	11,248.8
Mineable Reserves	Rough Stone in m^3	Topsoil m^3
	60,050.64	6045.8
Year wise Production for 5 years	Rough Stone in m^3	Topsoil m^3
	60,050.64	6045.8
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Machinery proposed	Jack Hammer	2 Nos
	Compressor	1 Nos
	Hydraulic Excavator	1 Nos
	Tippers	1 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	15 Nos	
Project Cost	Rs. 26,32,000/-	
CER Cost @ 2% of Project Cost	Rs 5,00,000/-	

TABLE 7.8: SALIENT FEATURES OF PROPOSAL "P4"

Name of the Quarry	Thiru. S. Manikandan Rough Stone Quarry		
Toposheet No	58-J/15		
Latitude between	10°28'01.77"N		
Longitude between	78°44'44.52"E		
Proposed Depth of Mining	32 m bgl		
Geological Resources	Rough Stone 98% in m^3	Mineral reject 2% in m^3	Topsoil m^3
	2,40,708	4,912	14,868
Mineable Reserves	Rough Stone 98% in m^3	Mineral reject 2% in m^3	Topsoil m^3
	76,126	1,554	9,348
Proposed Production for 5 Years	Rough Stone 98% in m^3	Mineral reject 2% in m^3	Topsoil m^3
	76,126	1,554	9,348
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Machinery proposed	Jack Hammer	6 Nos	
	Compressor	2 Nos	
	Hydraulic Excavator	1 Nos	
	Tippers	3 Nos	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.		
Proposed Manpower Deployment	18 Nos		
Project Cost	Rs. 15,25,000/-		
CER Cost @ 2% of Project Cost	Rs 5,00,000/-		

TABLE 7.9: SALIENT FEATURES OF EXISTING QUARRY "E1"

Name of the Quarry	Thiru. B. Kajamaideen Rough Stone Quarry	
Toposheet No	58-J/11	
Latitude between	10°28'11.90"N to 10°28'17.86"N	
Longitude between	78°44'45.01"E to 78°44'50.53"E	
Proposed Depth of Mining	47.5 m bgl	
Geological Resources	Rough Stone in m^3	Topsoil m^3
	7,78,905	43,272.5
Mineable Reserves	Rough Stone in m^3	Topsoil m^3
	1,90,935	29,182.5
Year wise Production for 5 years	Rough Stone in m^3	Topsoil m^3
	1,90,935	29,182.5
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Machinery proposed	Jack Hammer	5 Nos
	Compressor	1 Nos
	Hydraulic Excavator	1 Nos
	Tippers	2 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	24 Nos	
Project Cost	Rs. 51,99,450/-	
CER Cost @ 2% of Project Cost	Rs 5,00,000/-	

The Cumulative Impact is mainly anticipated due to drilling & blasting and excavation and transportation activities in all the quarries (proposed and existing) within the cluster and major impact anticipated is on Air & Noise Environment and Ground Vibrations due to blasting.

Air Environment –

Calculating the Cumulative Load of Mining within the cluster is as shown in table 7.17& 7.18.

TABLE 7.7: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE

Quarry	PROPOSED PRODUCTION DETAILS			
	5 Years in m^3	Per Year in m^3	Per Day in m^3	Number of Lorry Load Per Day
P1	42,620	8,524	28	3
P2	60,050.64	12,010	40	4
P4	76,126	15,225	51	5
Total	**1,78,796**	**35,759**	**119**	**12**
E1	1,90,935	38,187	127	11
Total	**1,90,935**	**38,187**	**127**	**11**
Grand Total	**3,69,731**	**73,946**	**246**	**23**

TABLE 7.8: CUMULATIVE PRODUCTION LOAD OF GRAVEL/WEATHERED/TOPSOIL

Quarry	PROPOSED PRODUCTION DETAILS			
	3 Years in m^3	Per Year in m^3	Per Day in m^3	Number of Lorry Load Per Day
P1	26,429	8,809	29	**3**
P2	6,045	2,015	7	1
P4	9,348	3,116	10	1
Total	**41,822**	**13,940**	**46**	**5**
E1	29182.5	9727	32	3
Total	**29,182.5**	**9,727**	**32**	**3**

| Grand Total | 71,004 | 23,667 | 78 | 8 |

On a cumulative basis considering the 3 quarries it can be seen that the overall production of Rough Stone is 246 m³ per day and overall production of topsoil is 78 m³ per day with a capacity of 23 trips of Rough Stone per day and 8 Trips per day of topsoil from the cluster.

Note: Per day production of Rough Stone is calculated for 5 Years Lease Period and for topsoil production with 1, 2 or 3 or 5 years of production period. And the load of existing quarries is covered under existing environment of the cluster.

Based on the above production quantities the emissions due to various activities in all the 5 mines includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 7.14.

TABLE 7.9: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS

EMISSION ESTIMATION FOR QUARRY "P1"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM₁₀	Drilling	Point Source	0.050793200	g/s
	Blasting	Point Source	0.000081779	g/s
	Mineral Loading	Point Source	0.037066773	g/s
	Haul Road	Line Source	0.002484720	g/s
	Overall Mine	Area Source	0.043164416	g/s
Estimated Emission Rate for SO₂	Overall Mine	Area Source	0.00015963	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000004973	g/s
EMISSION ESTIMATION FOR QUARRY "P2"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM₁₀	Drilling	Point Source	0.088668241	g/s
	Blasting	Point Source	0.001325730	g/s
	Mineral Loading	Point Source	0.042585246	g/s
	Haul Road	Line Source	0.002492418	g/s
	Overall Mine	Area Source	0.041709941	g/s
Estimated Emission Rate for SO₂	Overall Mine	Area Source	0.000662878	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000018210	g/s
EMISSION ESTIMATION FOR QUARRY "P4"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM₁₀	Drilling	Point Source	0.058484606	g/s
	Blasting	Point Source	0.000165509	g/s
	Mineral Loading	Point Source	0.037177594	g/s
	Haul Road	Line Source	0.002484798	g/s
	Overall Mine	Area Source	0.037412651	g/s
Estimated Emission Rate for SO₂	Overall Mine	Area Source	0.000169461	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000003821	g/s
EMISSION ESTIMATION FOR QUARRY "E1"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM₁₀	Drilling	Point Source	0.081979535	g/s
	Blasting	Point Source	0.000895657	g/s
	Mineral Loading	Point Source	0.042738230	g/s
	Haul Road	Line Source	0.002492793	g/s
	Overall Mine	Area Source	0.051140143	g/s
Estimated Emission Rate for SO₂	Overall Mine	Area Source	0.000688898	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000029962	g/s

Source: Emission Calculations

TABLE 7.10: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM_{10} in $\mu g/m^3$	
Location	**Core**
Background	59.29
Incremental	15.83
Resultant	75.12
NAAQ Norms	**100 $\mu g/m^3$**
$PM_{2.5}$ in $\mu g/m^3$	
Location	**Core**
Background	30.14
Highest Incremental	7.88
Resultant	38.02
NAAQ Norms	**60 $\mu g/m^3$**
SO_2 in $\mu g/m^3$	
Location	**Core**
Background	9.46
Incremental	2.49
Resultant	11.95
NAAQ Norms	**80 $\mu g/m^3$**
NO_x in $\mu g/m^3$	
Location	**Core**
Background	22.11
Incremental	11.68
Resultant	33.79
NAAQ Norms	**80 $\mu g/m^3$**

Noise Environment –

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. Cumulative Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities. Predictions have been carried out to compute the noise level at various distances around the different quarries within the 500 m radius.

For hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations at different sources using model based on first principle.

$Lp_2 = Lp_1 - 20 \log (r_2/r_1) - Ae_{1,2}$

Where:

Lp_1 & Lp_2 are sound levels at points located at distances r_1 & r_2 from the source.

$Ae_{1,2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$Lp_{total} = 10 \log \{10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} +......\}$

Attenuation due to Green Belt has been taken to be 4.9 dB (A). The inputs required for the model are:

Source data has been computed taking into account of all the machinery and activities used in the mining process.

TABLE 7.11: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER

Location ID	Background Value (Day) dB(A)	Incremental Value dB(A)	Total Predicted dB(A)	Residential Area Standards dB(A)

Habitation Near P1	54.30	43.0	54.6	
Habitation Near P2	54.05	43.8	54.4	55
Habitation Near P4	52.50	42.7	53.2	
Habitation Near E1	53.10	46.7	54.0	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 42.70 – 46.7 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A)the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations near habitations are within permissible limits of Residential Area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules 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), dated19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment(Protection) Act, 1986.).

Ground Vibrations

Ground vibrations due to mining activities in the all the 5 Mines within cluster are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc. However, the major source of ground vibration from the all the 5 mines is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining areas and may cause injury to persons or damage to the structures.
Nearest Habitations from 2 mines respectively are as in below Table 7.22

TABLE 7.12: NEAREST HABITATION FROM EACH MINE

Location ID	Distance in Meters
Habitation Near P1	350
Habitation Near P2	530
Habitation Near P3	310
Habitation Near P4	410
Habitation Near E1	310

The ground vibrations due to the blasting in all the mines are calculated using the empirical equation for assessment of peak particle velocity (PPV) is:

$$V = K\ [R/Q^{0.5}]\ ^{-B}$$

Where –
V = peak particle velocity (mm/s)
K = site and rock factor constant
Q = maximum instantaneous charge (kg)
B = constant related to the rock and site (usually 1.6)
R = distance from charge (m)

TABLE 7.13: GROUND VIBRATIONS AT 5 MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	6	350	0.178
P2	9	600	0.104
P4	11	530	0.149
E1	28	260	0.983

Source: Blasting Calculations

From the above table, the charge per blast is considered as maximum in each mine and the resultant PPV is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997.

Socio Economic Environment –

The 5 mines shall contribute towards CER and the community shall develop.

TABLE 7.14: SOCIO ECONOMIC BENEFITS FROM 5 MINES

Location ID	Project Cost	CER @ 2%
P1	Rs. 26,93,000	Rs 5,00,000 /-
P2	Rs. 26,32,000	Rs 5,00,000 /-
P4	Rs. 15,25,000	Rs 5,00,000 /-
Total	**Rs. 68,50,000**	**Rs 15,00,000 /-**
E1	Rs. 51,99,450/-	Rs 5,00,000/-
Total	**Rs. 51,99,450/-**	**Rs 5,00,000/-**
Grand Total	**Rs. 1,20,49,450**	**Rs. 20,00,000/-**

As per para 6 (II) of the office memorandum, all the mines being a green field project & Capital Investment is ≤ 100 crores, they shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC.

- Proposed project shall fund towards CER – **Rs 15,00,000/-**
- Existing project shall fund towards CER – **Rs 5,00,000/-**
- 5 Projects in Cluster shall fund towards CER – **Rs 20,00,000/-**

TABLE 7.15: EMPLOYMENT BENEFITS FROM 5 MINES

Location ID	Employment
P1	14
P2	15
P4	18
Total	**47**
E1	24
Total	**24**
Grand Total	**71**

A total of 47 people will get employment due to 4 proposed quarries in cluster and 24 people are already employed at existing mine.

TABLE 7.16: GREENBELT DEVELOPMENT BENEFITS FROM 5 MINES

CODE	No of Trees proposed to be planted	Survival %	Area Covered Sq.m	Name of the Species	No. of Trees expected to be grown
P1	750	80%	6,750	Neem, Casuarina	600
P2	750	80%	6,750	Neem, Casuarina	600
P3	500	80%	4,500	Neem, Casuarina	400
P4	500	80%	4,500	Neem, Casuarina	400
Total	**2500**	**80%**	**22,500**	Neem, Casuarina	**2,000**
E1	1000	80%	9,000	Neem, Casuarina	800
Total	**1000**	**80%**	**9,000**	**Neem, Casuarina**	**800**

Based on the Proposed Mining Plans it's anticipated that there shall growth of native species of Neem, Casuarina, etc in the Cluster at a rate of 2500 Trees Planted over a period of 5 Years with Survival Rate of 80% and expected growth is around 2000 Trees over an area of 22,500 Sq.m cumulative of proposed quarries and 1000 Trees Planted over a period of 5 Years with Survival Rate of 80% and expected growth is around 800 Trees over an area of 9,000 Sq.m cumulative of existing quarry.

7.5   PLASTIC WASTE MANAGEMENT PLAN

All the Project Proponent shall comply with Tamil Nadu Government Order (Ms) No. 84 Environment and Forest (EC.2) Department Dated: 25.06.2018 regarding ban on one time use and throw away plastics irrespective of thickness with effect from 01.01.2019 under Environment (Protection) Act, 1986.

Objective –

- To investigate the actual supply chain network of plastic waste.
- To identify and propose a sustainable plastic waste management by installing bins for collection of recyclables with all the plastic waste
- Preparation of a system design layout, and necessary modalities for implementation and monitoring.

TABLE 7.17: ACTION PLAN TO MANAGE PLASTIC WASTE

Sl.No.	Activity	Responsibility
1	Framing of Layout Design by incorporating provision of the Rules, user fee to be charged from waste generators for plastic waste management, penalties/fines for littering, burning plastic waste or committing any other acts of public nuisance	Mines Manager
2	Enforcing waste generators to practice segregation of bio-degradable, recyclable and domestic hazardous waste	Mines Manager
3	Collection of plastic waste	Mines Foreman
4	Setting up of Material Recovery Facilities	Mines Manager
5	Segregation of Recyclable and Non-Recyclable plastic waste at Material Recovery Facilities	Mines Foreman
6	Channelization of Recyclable Plastic Waste to registered recyclers	Mines Foreman
7	Channelization of Non-Recyclable Plastic Waste for use either in Cement kilns, in Road Construction	Mines Foreman
8	Creating awareness among all the stakeholders about their responsibility	Mines Manager
9	Surprise checking's of littering, open burning of plastic waste or committing any other acts of public nuisance	Mine Owner

Source: Proposed by FAE's and EC

8.   PROJECT BENEFITS

8.0   GENERAL

The Proposed Project for Quarrying Rough Stone at Thiru. C. Rengaraj aims to produce cumulatively **42,620** m^3 Rough Stone over a period of 5 Years. This will enhance the socio-economic activities in the adjoining areas and will result in the following benefits

- Increase in Employment Potential
- Improvement in Socio-Economic Welfare
- Improvement in Physical Infrastructure
- Improvement in Social infrastructure

8.1   EMPLOYMENT POTENTIAL

It is proposed to provide employment to about 14 persons for carrying out mining operations and give preference to the local people in providing employment in this Project. In addition, there will be opportunity for indirect employment to many people in the form of contractual jobs, business opportunities, service facilities etc. the economic status of the local people will be enhanced due to mining project.

8.2   SOCIO-ECONOMIC WELFARE MEASURES PROPOSED

The impact of mining activity in the area will be more positive on the socio-economic environment in the immediate project impact area. The employment opportunities both direct and indirect will contribute to enhanced money incomes to job seekers with minimal skill sets especially among the local communities.

8.3   IMPROVEMENT IN PHYSICAL INFRASTRUCTURE

The proposed quarry is located in Sathiyamangalam Village, Kulathur Taluk and Pudukkottai District of Tamil Nadu and the area have communications, roads and other facilities already well established. The following physical infrastructure facilities will further improve due to proposed mine.

- Road Transport facilities
- Communications
- Medical, Educational and social benefits will be made available to the nearby civilian population in addition to the workmen employed in the mine.

8.4   IMPROVEMENT IN SOCIAL INFRASTRUCTURE

Employment is expected during civil construction period, in trade, garbage lifting, sanitation and other ancillary services, Employment in these sectors will be primarily temporary or contractual and involvement of unskilled labour will be more. A major part of the labour force will be mainly from local villagers who are expected to engage themselves both in agriculture and mining activities. This will enhance their income and lead to overall economic growth of the area.

8.5   OTHER TANGIBLE BENEFITS

The proposed mine is likely to have other tangible benefits as given below.

- Indirect employment opportunities to local people in contractual works like construction of infrastructural facilities, transportation, sanitation, for supply of goods and services to the mine and other community services.
- Additional housing demand for rental accommodation will increase
- Cultural, recreation and aesthetic facilities will also improve
- Improvement in communication, transport, education, community development and medical facilities and overall change in employment and income opportunity
- The State Government will also benefit directly from the proposed mine, through increased revenue from royalties, cess, DMF, GST etc.,

CORPORATE SOCIAL RESPONSIBILITY

Project Proponent will take responsibility to develop awareness among all levels of their staff about CSR activities and the integration of social processes with business processes. Those involved with the undertaking of CSR activities will be provided with adequate training and re-orientation.

Under this programme, the project proponent will take-up following programmes for social and economic development of villages within 10 km of the project site. For this purpose, separate budget will be provided every year. For finalization of these schemes, proponent will interact with LSG. The schemes will be selected from the following broad areas –

- Health Services
- Social Development
- Infrastructure Development
- Education & Sports
- Self-Employment

CSR Cost Estimation

- CSR activities will be taken up in the Sathiyamangalam village mainly contributing to education, health, training of women self-help groups and contribution to infrastructure etc., CSR budget is allocated as 2.0% of the profit.

CORPORATE ENVIRONMENT RESPONSIBILITY

Allocation for Corporate Environment Responsibility (CER) shall be made as per Government of India, MoEF & CC Office Memorandum F.No.22-65/2017-IA.III, Dated: 01.05.2018.

As per para 6 (II) of the office memorandum, being a green field project & Capital Investment is ≤ 100 crores, Thiru. C. Rengaraj Blue Metals shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC. Cumulative Capital cost is Rs. 26,93,000/- and 2% of the same works out to Rs.53,860/-

TABLE 8.1: CER – ACTION PLAN

Activity	Beneficiaries	Total
Avenue Plantation along the Government School Boundary & Renovation of existing toilets	Sathiyamangalam villagers	Rs.5,00,000/-
TOTAL		**Rs.5,00,000/-**

Source: Field survey conducted by FAE, consultation with project proponent

9.   ENVIRONMENTAL COST BENEFIT ANALYSIS

Not Applicable, Since Environmental Cost Benefit Analysis not recommended at the Scoping stage.

10. ENVIRONMENTAL MANAGEMENT PLAN

10.0 GENERAL

Environment Management Plan (EMP) aims at the preservation of ecological system by considering in-built pollution abatement facilities at the proposed site. Good practices of Environmental Management plan will ensure to keep all the environmental parameters of the project in respect of Ambient Air quality, Water quality, Socio – economic improvement standards.

Mitigation measures at the source level and an overall environment management plan at the study area are elicited so as to improve the supportive capacity of the receiving bodies. The EMP presented in this chapter discusses the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored after approval of the EIA.

10.1 ENVIRONMENTAL POLICY

The Project Proponent is committed to conduct all its operations and activities in an environmentally responsible manner and to continually improve environmental performance.

The Proponent Thiru. C. Rengaraj will –

- Meet the requirements of all laws, acts, regulations, and standards relevant to its operations and activities
- Implement a program to train employees in general environmental issues and individual workplace environmental responsibilities
- Allocate necessary resources to ensure the implementation of the environmental policy
- Ensure that an effective closure strategy is in place at all stages of project development and that progressive reclamation is undertaken as early as possible to reduce potential long-term environmental and community impacts
- Implement monitoring programmes to provide early warning of any deficiency or unanticipated performance in environmental safeguards
- Conduct periodic reviews to verify environmental performance and to continuously strive towards improvement

Description of the Administration and Technical Setup –

The Environment Monitoring Cell discussed under Chapter 6 will ensure effective implementation of environment management plan and to ensure compliance of environmental statutory guidelines through Mine Management Level of each Proposed Quarry.

The said team will be responsible for:

- Monitoring of the water/ waste water quality, air quality and solid waste generated
- Analysis of the water and air samples collected through external laboratory
- Implementation and monitoring of the pollution control and protective measures/ devices which shall include financial estimation, ordering, installation of air pollution control equipment, waste water treatment plant, etc.
- Co-ordination of the environment related activities within the project as well as with outside agencies
- Collection of health statistics of the workers and population of the surrounding villages
- Green belt development
- Monitoring the progress of implementation of the environmental monitoring programme
- Compliance to statutory provisions, norms of State Pollution Control Board, Ministry of Environment and Forests and the conditions of the environmental clearance as well as the consents to establish and consents to operate.

10.2   LAND ENVIRONMENT MANAGEMENT

Landscape of the area will be changed due to the quarrying operation, restoration of the land by converting the quarry pit into temporary reservoir and the remaining part of the area (un utilized areas, infrastructure, haul Roads) will be utilized for greenbelt development. Aesthetic of the Environment will not be affected. There is no major vegetation in the project area during the course of quarrying operation and after completion of the quarrying operation thick plantation will be developed under greenbelt development programme.

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

CONTROL	RESPONSIBILITY
Design vehicle wash-down areas so that all runoff water is captured and passed through oil water separators and sediment catchment devices.	Mines Manager
Refueling to be undertaken in a safe location, away from vehicle movement pathways&100 m away of any watercourse Refueling activity to be under visual observation at all times. Drainage of refueling areas to sumps with oil/water separation	Mine Foreman & Mining Mate
Soil and groundwater testing as required following up a particular incident of contamination.	Mines Manager
At conceptual stage, the mining pits will be converted into Rain Water Harvesting. Remaining area will be converted into greenbelt area	Mines Manager
No external dumping i.e., outside the project area	Mine Foreman
Garland drains with catch pits / settlement traps to be provided all around the project area to prevent run off affecting the surrounding lands.	Mines Manager
The periphery of Project area will be planted with thick plantation to arrest the fugitive dust, which will also act as acoustic barrier.	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.3   SOIL MANAGEMENT

There is no overburden or waste anticipated from proposed project.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

CONTROL	RESPONSIBILITY
Surface run-off from the project boundary via garland drains will be diverted to the mine pits	Mine Foreman & Mining Mate
Design haul roads and other access roads with drainage systems to minimize concentration of flow and erosion risk	Mines Manager
Empty sediment from sediment traps Maintain, repair or upgrade garland drain system	Mines Manager
Test soils for pH, EC, chloride, size & water holding capacity	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.4   WATER MANAGEMENT

In the proposed quarrying project, no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mines office.

The quarrying operation is proposed upto a depth of 30m BGL, the water table in the area is 65 m – 70 m below ground level, hence the proposed projects will not intersect the Ground water table during entire quarry period.

TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT

CONTROL	RESPONSIBILITY
To maximize the reuse of pit water for water supply	Mines Foreman
Temporary and permanent garland drain will be constructed to contain the catchments of the mining area and to divert runoff from undisturbed areas through the mining areas	Mines Manager
Natural drains/nallahs/brooklets outside the project area should not be disturbed at any point of mining operations	Mines Manager
Ensure there is no process effluent generation or discharge from the project area into water bodies	Mines Foreman
Domestic sewage generated from the project area will be disposed in septic tank and soak pit system	Mines Foreman
Monthly or after rainfall, inspection for performance of water management structures and systems	Mines Manager
Conduct ground water and surface water monitoring for parameters specified by CPCB	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.5   AIR QUALITY MANAGEMENT

The proposed quarrying activity would result in the increase of particulate matter concentrations due to fugitive dust. Daily water sprinkling on the haul roads, approach roads in the vicinity would be undertaken and will be continued as there is possibility for dust generation due to truck mobility. It will be ensured that vehicles are properly maintained to comply with exhaust emission requirements

TABLE 10.4: PROPOSED CONTROLS FOR AIR ENVIRONMENT

CONTROL	RESPONSIBILITY
Generation of dust during excavation is minimized by daily (twice) water sprinkling on working face and daily (twice) water sprinkling on haul road	Mines Manager
Wet drilling procedure /drills with dust extractor system to control dust generation during drilling at source itself is implemented	Mines Manager
Maintenance as per operator manual of the equipment and machinery in the mines to minimizing air pollution	Mines Manager
Ambient Air Quality Monitoring carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted air pollution control measures	Mines Manager
Provision of Dust Mask to all workers	Mines Manager
Greenbelt development all along the periphery of the project area	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.6   NOISE POLLUTION CONTROL

There will be intermittent noise levels due to vehicular movement, trucks loading, drilling and blasting and cutting activities. No mining activities are planned during night time.

TABLE 10.5: PROPOSED CONTROLS FOR NOISE ENVIRONMENT

CONTROL	RESPONSIBILITY
Development of thick greenbelt all along the Buffer Zone (7.5 Meters) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn-out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager

Provision of earmuff / ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager
Sharp drill bits are used to minimize noise from drilling	Mines Foreman
Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring shall be carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted noise control measures. Additional noise control measures will be adopted if required as per the observations during monitoring	Mines Manager
Reduce maximum instantaneous charge using delays while blasting	Mining Mate
Change the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination	Mines Manager
Undertake noise or vibration monitoring	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.7 GROUND VIBRATION AND FLY ROCK CONTROL

The Rough stone quarry operation creates vibration due to the blasting and movement of Heavy Earth moving machineries, fly rocks due to the blasting.

TABLE 10.6: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK

CONTROL	RESPONSIBILITY
Controlled blasting using delay detonators will be carried out to maintain the PPV value (below 8Hz) well within the prescribed standards of DGMS	Mines Manager
Drilling and blasting will be carried under the supervision of qualified persons	Mines Manager
Proper stemming of holes should be carried out with statutory competent qualified blaster under the supervision of statutory mines manager to avoid any anomalies during blasting	Mines Manager
Suitable spacing and burden will be maintained to avoid misfire / fly rocks	Manager Mines
Number of blast holes will be restricted to control ground vibrations	Manager Mines
Blasting will be carried out only during noon time	Mining Mate
Undertake noise or vibration monitoring	Mines Manager
ensure blast holes are adequately stemmed for the depth of the hole and stemmed with suitable angular material	Mines Foreman

Source: Proposed by FAE's & EIA Coordinator

10.8 BIOLOGICAL ENVIRONMENT MANAGEMENT

The proponent will take all necessary steps to avoid the impact on the ecology of the area by adopting suitable management measures in the planning and implementation stage. During mining, thick plantation will be carried out around the project periphery, on safety barrier zone, on top benches of quarried out area etc.,

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.
- Greenbelt development all along the safety barrier of the project area
- It is also proposed to implement the greenbelt development programme and post plantation status will be regularly checked for every season.
- The main attributes that retard the survival of sapling is fugitive dust, this fugitive dust can be controlled by water sprinkling on the haul roads and installing a sprinkler unit near the newly planted area.
- Year wise greenbelt development will be recorded and monitored
  - Based on the area of plantation.
  - Period of plantation

- ▪ Type of plantation
- ▪ Spacing between the plants
- ▪ Type of manuring and fertilizers and its periods
- ▪ Lopping period, interval of watering
- ▪ Survival rate
- ▪ Density of plantation
- • The ultimate reclamation planned leaves a congenial environment for development of flora & immigration of small fauna through green belt and water reservoir. The green belt and water reservoir developed within the Project at the end of mine life will attract the birds and animals towards the project area in the post mining period.

10.8.1   Green Belt Development Plan

About 750 nos. of saplings is proposed to be planted for the Mining plan period in safety barrier of applied mine lease area with survival rate 80%. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

TABLE 10.7 PROPOSED GREENBELT ACTIVITIES FOR5 YEAR PLAN PERIOD

Year	No. of tress proposed to be planted	Area to be covered	Name of the species	Survival rate expected	No. of trees expected to be grown
I	750	Along safety area, panchayat road and village road	Neem, Pongamia Pinnata, Casuarina etc.,	80%	600

Source: Conceptual Plan of Approved Mining plan& proposed by FAE's & EIA Coordinator

The objectives of the greenbelt development plan are –
- • Provide a green belt around the periphery of the quarry area to combat the dispersal of dust in the adjoining areas,
- • Protect the erosion of the soil, Conserve moisture for increasing ground water recharging,
- • Restore the ecology of the area, restore aesthetic beauty of the locality and meet the requirement of fodder, fuel and timber of the local community.

A well-planned Green Belt with multi rows (three tiers) preferably with long canopy leaves shall be developed with dense plantations around the boundary and haul roads to prevent air, dust noise propagation to undesired places and efforts will be taken for the enhancement of survival rate.

10.8.2   Species Recommended for Plantation

Following points have been considered while recommending the species for plantation:

- • Creating of bio-diversity.
- • Fast growing, thick canopy cover, perennial and evergreen large leaf area,
- • Efficient in absorbing pollutants without major effects on natural growth

TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT

S.No	Botanical Name	Local Name	Importance
1.	Azadirachta indica	Neem, Vembu	Neem oil & neem products
2.	Tamarindus indica	Tamarind	Edible & Medicinal and other Uses
3.	Polyalthia longifolia	Nettilinkam	Tall and evergreen tree
4.	Borassus Flabellifer	Palmyra Palm	Tall Wind breaker tree and its fruits are edible

Source: Proposed by FAE's & EIA Coordinator

10.9   OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

Occupational safety and health are very closely related to productivity and good employer-employee relationship. The main factors of occupational health impact in quarries are fugitive dust and noise. Safety of employees during quarrying operation and maintenance of mining equipment will be taken care as per Mines Act 1952 and Rule 29 of Mines Rules 1955. To avoid any adverse effect on the health of workers due to dust, noise and vibration sufficient measures have been provided.

10.9.1   Medical Surveillance and Examinations

- Identifying workers with conditions that may be aggravated by exposure to dust & noise and establishing baseline measures for determining changes in health.

- Evaluating the effect of noise on workers

- Enabling corrective actions to be taken when necessary

- Providing health education

The health status of workers in the mine shall be regularly monitored under an occupational surveillance program. Under this program, all the employees are subjected to a detail medical examination at the time of employment. The medical examination covers the following tests under mines act 1952.

- General Physical Examination and Blood Pressure

- X-ray Chest and ECG

- Sputum test

- Detailed Routine Blood and Urine examination

The medical histories of all employees will be maintained in a standard format annually. Thereafter, the employees will be subject to medical examination annually. The below tests keep upgrading the database of medical history of the employees.

TABLE 10.9: MEDICAL EXAMINATION SCHEDULE

Sl.No	Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Initial Medical Examination (Mine Workers)					
A	Physical Check-up					
B	Psychological Test					
C	Audiometric Test					
D	Respiratory Test					
2	Periodical Medical Examination (Mine Workers)					
A	Physical Check – up					
B	Audiometric Test					
C	Eye Check – up					
D	Respiratory Test					
3	Medical Camp (Mine Workers & Nearby Villagers)					
4	Training (Mine Workers)					

Medical Follow ups:- Work force will be divided into three targeted groups age wise as follows:-		
Age Group	**PME as per Mines Rules 1955**	**Special Examination**
Less than 25 years	Once in a Three Years	In case of emergencies
Between 25 to 40 Years	Once in a Three Years	In case of emergencies
Above 40 Years	Once in a Three Years	In case of emergencies
Medical help on top priority immediately after diagnosis/ accident is the essence of preventive aspects.		

10.9.2   Proposed Occupational Health and Safety Measures

- The mine site will have adequate drinking water supply so that workers do not get dehydrated.
- Lightweight and loose fitting clothes having light colours will be preferred to wear.
- Noise exposure measurements will be taken to determine the need for noise control strategies.
- The personal protective equipment will be provided for mine workers.
- Supervisor will be instructed for reporting any problems with hearing protectors or noise control equipment.
- At noisy working activity, exposure time will be minimized.
- Dust generating sources will be identified and proper control measure will be adopted.
- Periodic medical examinations will be provided for all workers.
- Strict observance of the provisions of DGMS Acts, Rules and Regulations in respect of safety both by management and the workers.
- The width of road will be maintained more than thrice the width of the vehicle. A code of traffic rules will be implemented.
- In respect of contract work, safety code for contractors and workers will be implemented. They will be allowed to work under strict supervision of statutory person/officials only after they will impart training at vocational training centres. All personal protective equipment's will be provided to them.
- A safety committee meeting every month will be organized to discuss the safety of the mines and the persons employed.
- Celebration of annual mines safety week and environmental week in order to develop safety awareness and harmony amongst employees and co quarry owners.

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS

10.9.3   Health and Safety Training Programme

The Proponents will provide special induction program along with machinery manufacturers for the operators and co-operators to run and maintain the machinery effectively and efficiently. The training program for the supervisors and office staffs will be arranged in the Group Vocational Training Centres in the State and engage Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner.

TABLE 10.10: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES

Course	Personnel	Frequency	Duration	Instruction
New-Employee Training	All new employees exposed to mine hazards	Once	One week	Employee rights Supervisor responsibilities Self-rescue Respiratory devices Transportation controls Communication systems Escape and emergency evacuation Ground control hazards Occupational health hazards Electrical hazards First aid Explosives
Task Training Like Drilling, Blasting, Stemming, safety, Slope stability, Dewatering, Haul Road maintenance,	Employees assigned to new work tasks	Before new Assignments	Variable	Task-specific health &safety procedures and SOP for various mining activity. Supervised practice in assigned work tasks.
Refresher Training	All employees who received new-hire training	Yearly	One week	Required health and safety standards Transportation controls Communication systems Escape ways, emergency evacuations Fire warning Ground control hazards First aid Electrical hazards Accident prevention Explosives Respirator devices
Hazard Training	All employees exposed to mine hazards	Once	Variable	Hazard recognition and avoidance Emergency evacuation procedures Health standards Safety rules Respiratory devices

Source: Proposed by FAE's & EIA Coordinator as per DGMS Norms

10.9.4 Budgetary Provision for Environmental Management –

Adequate budgetary provision has been made by the Company for execution of Environmental Management Plan. The Table 10.11 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

TABLE 10.11: EMP BUDGET FOR PROPOSED PROJECT

	Mitigation Measure	Provision for Implementation	Capital	Recurring
Air Environment	Compaction, gradation and drainage on both sides for Haulage Road	Rental Dozer & drainage construction on haul road @ Rs. 10,000/- per hectare; and yearly maintenance @ Rs. 10,000/- per hectare	13400	13400
	Fixed Water Sprinkling Arrangements + Water sprinkling by own water tankers	Fixed Sprinkler Installation and New Water Tanker Cost for Capital; and Water Sprinkling (thrice a day) Cost for recurring	800000	50000
	Muffle blasting – To control fly rocks during blasting	Blasting face will be covered with sand bags / steel mesh / old tyres / used conveyor belts	0	5000
	Wet drilling procedure / latest eco-friendly drill machine with separate dust extractor unit	Dust extractor @ Rs. 25,000/- per unit deployed as capital & @ Rs. 2500 per unit recurring cost for maintenance - 2 Units	50000	5000
	No overloading of trucks/tippers/tractors	Manual Monitoring through Security guard	0	5000
	Stone carrying trucks will be covered by tarpaulin	Monitoring if trucks will be covered by tarpaulin	0	10000
	Enforcing speed limits of 20 km/hr within ML area	Installation of Speed Governers @ Rs. 5000/- per Tipper/Dumper deployed - 1 Units	5000	250
	Regular monitoring of exhaust fumes as per RTO norms	Monitoring of Exhaust Fumes by Manual Labour	0	5000
	Regular sweeping and maintenance of approach roads for at least about 200 m from ML Area	Provision for 2 labours @ Rs.10,000/labour (Contractual) per Hectare	0	26800
	Installing wheel wash system near gate of quarry	Installation + Maintenance + Supervision	50000	20000
Noise Environment	Source of noise will be during operation of transportation vehicles, HEMM for this proper maintenance will be done at regular intervals.	Provision made in Operating Cost	0	0
	Oiling & greasing of Transport vehicles and HEMM at regular interval will be done	Provision made in Operating Cost	0	0
	Adequate silencers will be provided in all the diesel engines of vehicles.	Provision made in Operating Cost	0	0

	It will be ensured that all transportation vehicles carry a fitness certificate.	Provision made in Operating Cost	0	0
	Safety tools and implements that are required will be kept adequately near blasting site at the time of charging.	Provision made in OHS part	0	0
	Line Drilling all along the boundary to reduce the PPV from blasting activity and implementing controlled blasting.	Provision made in Operating Cost	0	0
	Proper warning system before blasting will be adopted and clearance of the area before blasting will be ensured.	Blowing Whistle by Mining Mate / Blaster / Compentent Person	0	0
	Provision for Portable blaster shed	Installation of Portable blasting shelter	50000	2000
	NONEL Blasting will be practiced to control Ground vibration and fly rocks	Rs. 30/- per 6 Tonnes of Blasted Material	0	110812
Water Environment	Water management	Provision for garland drain @ Rs. 10,000/- per Hectare with maintenance of Rs. 5,000/- per annum	13400	5000
Waste Management	Waste management (Spent Oil, Grease etc.,)	Provision for domestic waste collection and disposal through authorized agency	5000	20000
		Installation of dust bins	5000	2000
	Bio toilets will be made available outside mine lease on the land of owner itself	Provision made in Operating Cost	0	0
Green Belt Development	Green belt development - 500 trees per one hectare - Proposal for 750 Trees - (250 Inside Lease Area & 500 Outside Lease Area)	Site clearance, preparation of land, digging of pits / trenches, soil amendments, transplantation of saplings @ 200 per plant (capital) for plantation inside the lease area and @ 30 per plant maintenance (recurring)	50000	7500

		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	150000	15000
Implementation of EC, Mining Plan & DGMS Condition	Size 6' X 5' with blue background and white letters as mentioned in MoM Appendix II by the SEAC TN	Fixed Display Board at the Quarry Entrance as permanent structure mentioning Environmental Conditions	10000	1000
	Air, Water, Noise and Soil Quality Sampling every 6 Months for Compliance Report of EC Conditions	Submission of 2 Half Yearly Compliance - Lab Monitoring Report as per CPCB norms	0	50000
	Workers will be provided with Personal Protective Equipment's	Provision of PPE @ Rs. 4000/- per employee with recurring based on wear and tear (say, @ Rs. 1000/- per employee) - 14 Employees	56000	14000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	14000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	2680
	Mine will have safety precaution signages, boards.	Provision for signages and boards made	10000	2000
	Barbed Wire Fencing to quarry area will be provisioned.	Per Hectare fencing Cost @ Rs. 2,00,000/- with Maintenance of Rs 10,000/- per annum	268000	10000
	No parking will be provided on the transport routes. Separate provision on the south side of the hill will be made for vehicles /HEMMs. Flaggers will be deployed for traffic management	Parking area with shelter and flags @ Rs. 50,000/- per hectare project and Rs. 10,000/- as maintenance cost	67000	10000

	Installation of CCTV cameras in the mines and mine entrance	Camera 4 Nos, DVR, Monitor with internet facility	30000	5000
	Implementation as per Mining Plan and ensure safe quarry working	Mines Manager (1st Class / 2nd Class / Mine Foreman) under regulation 34 / 34 (6) of MMR, 1961 and Mining Mate under regulation 116 of MMR,1961 @ 40,000/- for Manager & @ 25,000/- for Foreman / Mate	0	780000
TOTAL			**1632800**	**1191442**

In order to implement the environmental protection measures, an amount of Rs.16.32 lakhs as capital cost and recurring cost as Rs. 11.91 lakhs as recurring cost is proposed considering present market price considering present market scenario for the proposed project.

10.10   CONCLUSION –

Various aspects of mining activities were considered and related impacts were evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and fund has been allocated for the same. The EMP is dynamic, flexible and subjected to periodic review. For project where the major environmental impacts are associated, EMP will be under regular review. Senior Management responsible for the project will conduct a review of EMP and its implementation to ensure that the EMP remains effective and appropriate. Thus, the proper steps will be taken to accomplish all the goals mentioned in the EMP and the project will bring the positive impact in the study area.

11.   SUMMARY AND CONCLUSION

Thiru. C. Rengaraj Rough Stone Quarry (Extent – 1.34.0 ha) falls under "B" category as per MoEF & CC Notification (S.O. 3977 (E)).

Now, as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018 clarified the requirement for EIA, EMP and therefore, Public Consultation for all areas from 5 to 25 ha falling in Category B-1 and appraised by SEAC/ SEIAA as well as for cluster situation.

Environmental monitoring and audit mechanism have been recommended before and after commencement of the project, where necessary, to verify the accuracy of the EIA predictions and the effectiveness of recommended mitigation measures.

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the months March to May 2022 for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suitable mitigation measures for likely adverse impacts due to the proposed project is suggested individually for the respective proposed project under Chapter 10.

The project proponent ensures to obtain necessary clearances and quarrying will be carried out as per rules and regulations. The Mining Activity will be carried out in a phased manner as per the approved mining plan after obtaining EC, CTO from TNPCB, execution of lease deed and obtaining DGMS Permission and working will be carried out under the supervision of Competent Persons employed.

Overall, the EIA report has predicted that the project will comply with all environment standards and legislation after commencement of the project and operational stage mitigation measures are implemented.

Mining operations has positive impact on environment and socio economy such as landscape improvement, water as by-product, economy development and better public services, providing and supply of Rough Stone as per market demand.

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 14 people directly in the project and indirectly around 10 people.

As discussed, it is safe to say that the proposed quarry is not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits. Green belt development around the area will also be taken up as an effective pollution mitigate technique, as well as to serve as biological indicators for the pollutants released from the Thiru. C. Rengaraj Rough Stone Quarry (Extent – 1.34.0 ha).

12.   DISCLOSURE OF CONSULTANT

Thiru. C. Rengaraj have engaged M/s Geo Exploration and Mining Solutions, an Accredited Organization under Quality Council of India – National Accreditation Board for Education & Training, New Delhi, for carrying out the EIA Study as per the ToR Issued and Standard ToR Deemed Approved.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS
No 17, Advaitha Ashram Road,
Alagapuram, Salem – 636 004
Tamil Nadu, India
Email:infogeoexploration@gmail.com
Web: www.gemssalem.com
Phone: 0427 2431989.

The Accredited Experts and associated members who were engaged for this EIA study as given below –

Sl.No.	Name of the expert	In house/ Empanelled	EIA Coordinator		FAE	
			Sector	Category	Sector	Category
1	**Dr. M. Ifthikhar Ahmed**	**In-house**	**1**	**A**	WP GEO SC	B A A
2	Dr. P. Thangaraju	In-house	-	-	HG GEO	A A
3	Mr. A. Jagannathan	In-house	-	-	AP NV SHW	B A B
4	Mr. N. Senthilkumar	Empanelled	38 28	B B	AQ WP RH	B B A
5	Mrs. Jisha parameswaran	In-house	-	-	SW	B
6	Mr. Govindasamy	In-house	-	-	WP	B
7	Mrs. K. Anitha	In-house	-	-	SE	A
8	Mrs. Amirtham	In-house	-	-	EB	B
9	Mr. Alagappa Moses	Empanelled	-	-	EB	A
10	Mr. A. Allimuthu	In-house	-	-	LU	B
11	Mr. S. Pavel	Empanelled	-	-	RH	B
12	Mr. J. R. Vikram Krishna	Empanelled	-	-	SHW RH	A A

Abbreviations			
EC	EIA Coordinator	EB	Ecology and bio-diversity
AEC	Associate EIA Coordinator	NV	Noise and vibration
FAE	Functional Area Expert	SE	Socio economics
FAA	Functional Area Associates	HG	Hydrology, ground water and water conservation
TM	Team Member	SC	Soil conservation
GEO	Geology	RH	Risk assessment and hazard management
WP	Water pollution monitoring, prevention and control	SHW	Solid and hazardous wastes
AP	Air pollution monitoring, prevention and control	MSW	Municipal Solid Wastes
LU	Land Use	ISW	Industrial Solid Wastes
AQ	Meteorology, air quality modeling, and prediction	HW	Hazardous Wastes

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/EMP

Declaration by experts contributing to the EIA/EMP for Thiru. C. Rengaraj Rough Stone & Gravel Quarry Project at S.F.No. 217/3A, 217/20, 217/21, 217/22 & 217/24 over an Extent of 1.34.0 ha in Sathiyamangalam Village of Kulathur Taluk, Pudukkottai District of Tamil Nadu. It is also certified that information furnished in the above EIA study are true and correct to the best of our Knowledge.

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the EIA/EMP Report.

Name: **Dr. M. Ifthikhar Ahmed**

Designation: **EIA Coordinator**

Date & Signature:
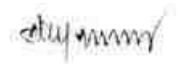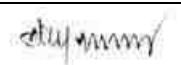
Period of Involvement: **January 2019 to till date**

Associated Team Member with EIA Coordinator:
1. **Mr. S. Nagamani**
2. **Mr. P.Viswanathan**
3. **Mr. Santhoshkumar**
4. **Mr. S. Ilavarasan**

FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

Sl. No.	Functional Area	Involvement	Name of the Expert/s	Signature
1	AP	▪ Identification of different sources of air pollution due to the proposed mine activity ▪ Prediction of air pollution and propose mitigation measures / control measures	Mr. A. Jagannathan	
2	WP	▪ Suggesting water treatment systems, drainage facilities ▪ Evaluating probable impacts of effluent/waste water discharges into the receiving environment/water bodies and suggesting control measures.	Dr. M. Ifthikhar Ahmed / Mr. N. Senthilkumar	
3	HG	▪ Interpretation of ground water table and predict impact and propose mitigation measures. ▪ Analysis and description of aquifer Characteristics	Dr. P. Thangaraju	
4	GEO	▪ Field Survey for assessing the regional and localgeology of the area. ▪ Preparation of mineral and geological maps. ▪ Geology and Geo morphological analysis/description and Stratigraphy/Lithology.	Dr. M. Ifthikhar Ahmed / Dr. P. Thangaraju	
5	SE	▪ Revision in secondary data as per Census ofIndia, 2011. ▪ Impact Assessment & Preventive ManagementPlan ▪ Corporate Environment Responsibility.	Mrs. K. Anitha	
6	EB	▪ Collection of Baseline data of Flora and Fauna. ▪ Identification of species labelled as Rare, Endangered and threatened as per IUCN list.	Mrs. Amirtham	

		▪ Impact of the project on flora and fauna. ▪ Suggesting species for greenbelt development.	Mr. Alagappa Moses	
7	RH	▪ Identification of hazards and hazardous substances ▪ Risks and consequences analysis ▪ Vulnerability assessment ▪ Preparation of Emergency Preparedness Plan ▪ Management plan for safety.	Mr. N. Senthilkumar	
			Mr. S. Pavel	
			Mr. J. R. Vikram Krishna	
8	LU	▪ Construction of Land use Map ▪ Impact of project on surrounding land use ▪ Suggesting post closure sustainable land use and mitigative measures.	Mr. A. Allimuthu	
9	NV	▪ Identify impacts due to noise and vibrations ▪ Suggesting appropriate mitigation measures for EMP.	Mr. A. Jagannathan	
10	AQ	▪ Identifying different source of emissions and propose predictions of incremental GLC using AERMOD. ▪ Recommending mitigations measures for EMP	Mr. N. Senthilkumar	
11	SC	▪ Assessing the impact on soil environment and proposed mitigation measures for soil conservation	Dr. M. Ifthikhar Ahmed	
12	SHW	▪ Identify source of generation of non-hazardous solid waste and hazardous waste. ▪ Suggesting measures for minimization of generation of waste and how it can be reused or recycled.	Mr. A. Jagannathan	
			Mr. J. R. Vikram Krishna	

LIST OF TEAM MEMBERS ENGAGED IN THIS PROJECT

Sl.No.	Name	Functional Area	Involvement	Signature
1	Mr. S. Nagamani	AP; GEO; AQ	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Provide inputs on Geological Aspects ▪ Analyse & provide inputs and assist FAE with meteorological data, emission estimation, AERMOD modelling and suggesting control measures	
2	Mr. Viswanathan	AP; WP; LU	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Assisting FAE on sources of water pollution, its impacts and suggest control measures ▪ Assisting FAE in preparation of land use maps	
3	Mr. Santhoshkumar	GEO; SC	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
4	Mr. Umamahesvaran	GEO	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects	

			▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan	
5	Mr. A. Allimuthu	SE	▪ Site Visit with FAE ▪ Assist FAE with collection of data's ▪ Provide inputs by analysing primary and secondary data	Allimuthu
6	Mr. S. Ilavarasan	LU; SC	▪ Site Visit with FAE ▪ Assisting FAE in preparation of land use maps ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	S. Il
7	Mr. E. Vadivel	HG	▪ Site Visit with FAE ▪ Assist FAE & provide inputs on aquifer characteristics, ground water level/table ▪ Assist with methods of ground water recharge and conduct pump test, flow rate	E. Vadivel
8	Mr. D. Dinesh	NV	▪ Site Visit with FAE ▪ Assist FAE and provide inputs on impacts due to proposed mine activity and suggest mitigation measures ▪ Assist FAE with prediction modelling	
9	Mr. Panneer Selvam	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	P Panshy
10	Mrs. Nathiya	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	T. amya

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Ifthikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above-mentioned Functional Area Experts and Team Members prepared the EIA/EMP for Thiru. C. Rengaraj Rough Stone & Gravel Quarry Project over an Extent of 1.34.0 ha in Sathiyamangalam Village of Kulathur Taluk, Pudukkottai District of Tamil Nadu. It is also certified that information furnished in the EIA study are true and correct to the best of our knowledge.

Signature& Date:

Name: **Dr. M. Ifthikhar Ahmed**

Designation: **Managing Partner**

Name of the EIA Consultant Organization: **M/s. Geo Exploration and Mining Solutions**

NABET Certificate No & Issue Date: **NABET/EIA/1922/SA0139 Dated: 11-10-2021**

Validity: **Valid till 29.1.2023**