DRAFT OF ENVIRONMENTAL IMPACT ASSESSMENT
AND
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 = 13.57.0 hectares

ROUGHSTONE AND GRAVEL QUARRY

At

Katchaikatti Village, Vadipatti Taluk, Madurai District,

Tamil Nadu State

ToR Letter No. SEIAA-TN/F.No.9858/SEAC/ToR-1441/2023 Dated 10.05.2023.

NAME AND ADDRESS OF THE PROPOSED PROJECT PROPONENT

Name and Address	Extent & S.F.No.
Thiru. B. Karuppaiah, S/o.Bose, No. 209 A, Vilakkulam, Puliyangulam, Melapidayur, Sivagangai District - 630606	2.01.5 ha & 1199/1B, 1199/1C, 1199/1D, 1199/1E, 1199/1F, 1199/1H, 1199/1I, 1199/1J, 1199/1K, 1193/1, 1193/2

ENVIRONMENTAL CONSULTANT

GEO TECHNICAL MINING SOLUTIONS

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NABET ACC. NO: NABET/EIA/2124/SA 0184
Valid till: Dec 31, 2023

ENVIRONMENTAL LAB

ACCURACY ANALABS AND
ENVIRO FARMERS LABS & TECHNOLOGIES

Baseline Study Period – March through May 2023

TERMS OF REFERENCE (ToR) COMPLIANCE

ToR issued vide Letter No. SEIAA-TN/F.No.9858/SEAC/ToR-1441/2023 dated 10.05.2023 for Thiru.B.Karuppaiah Rough stone & gravel Quarry

REMARKS FROM SEAC		
1	The structures within the radius of 50 m, 100 m, 200 m, 300 m shall be enumerated with details such as dwelling houses with number of occupants, whether it belongs to the owner or not, places of worship, industries, factories, sheds etc.	The report about the structures within the radius of 50 m, 100 m, 200 m, 300 m will be attached with final EIA report.
2	The PP shall spell out the mitigation measures considering the existence of Veguthumalai Reserved Forest at a distance of 340m from the proposed quarry site.	The details regarding are given in the Table 3.42 under Chapter III, p.103
3	The proponent shall carry out Bio diversity study through reputed Institution and the same shall be included in EIA Report.	Details regarding Bio diversity is given in the Section 3.5 under Chapter III, pp.73-96
4	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.	Photographs showing green belt, fencing and garland drain will be included in the final EIA report.
5	In the case of proposed lease in an existing (or old) quarry where the benches are not formed (or) partially formed as per the approved Mining plan, the project proponent (PP) shall prepare and submit an 'Slope Stability Action	Slope stability report will be included in final EIA report.

	plan' for carrying out the realignment of the benches in the proposed quarry lease after it is approved by the concerned Asst. Director and mining during the time of appraisal for obtaining the EC.		
6	The PP shall furnish the affidavit stating that the blasting operation in the proposed quarry is carried out by the statutory competent person as per the MMR 1961 such as blaster, mining mate, mine foreman, II/I Class mines manager appointed by the proponent.		The affidavit for blasting has been enclosed in the approved mining plan report.
7	The PP shall present a conceptual design for carrying out only controlled blasting operation involving line drilling and muffle blasting in the proposed quarry such that the blast-induced ground vibrations are controlled as well as no fly rock travel beyond 30 m from the blast site.		A conceptual design of blasting has been given in Section 2.6 under Chapter II, pp.22-32.
8	The EIA Coordinators shall obtain and furnish the details of quarry/quarries operated by the proponent in the past, either in the same location or elsewhere in the state with video and photographic evidences.		The document containing video and photographic evidences will be submitted in the final EIA report.
9	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?	As the proposed project is a green field project, the conditions are not applicable to this project.

	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.	
10	All corner coordinates of the mine lease area. superimposed on a High-Resolution Imagery/Toposheet, 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).		All corner coordinates of the mine lease area have been superimposed on a high-resolution Google Earth Image, as shown in Figure 2.4, under Chapter II, p-15.
11	The PP shall carry out Drone video survey covering the cluster, green belt, fencing etc.,		Drone video coverage will be submitted in the final EIA report.
12	The PP shall furnish the revised manpower including the statutory & competent persons as required under-the provisions of the MMR 1961 for the prosed quarry based on the volume of		Details of manpower required for this project have been given in Table 2.14 under Chapter II, p.33.

	rock handled & area of excavation.	
13	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.	Photographs of adequate fencing, green belt of the project is included in the Section 4.6 under Chapter IV, pp.125-131.
14	The Project Proponent shall provide the details of mineral reserves and mineable reserves, planned production capacity, proposed working methodology with justifications, the anticipated impacts of the mining operations on the surrounding environment and the remedy al measures for the same.	The mineral reserves of the project have been discussed in Section 2.5 under Chapter II, pp.19-21 The anticipated impact of mining on land, air, noise, water, soil, biology, and socio economy is discussed under Chapter IV, pp.107-135.
15	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.	Employment details of the proposed project are provided in Table 2.14 under Chapter II, p.33.
16	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 1 km (radius) along with the	Detailed hydrogeological study was carried out. The results have been discussed Section 3.2 under Chapter III, pp.46-58.

	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 in this regard may be provided.	
17	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.	The baseline data were collected for the environmental components including land, soil, water, air, noise, biology, socio-economy, and traffic and the results have been discussed under Chapter III, pp. 34-106.
18	The Proponent shall carry out the Cumulative impact study due to mining operations carried out in the quarry specifically with reference to the specific environment in terms of soil health, biodiversity, air pollution, water pollution, climate change and flood control & health impacts. Accordingly, the Environment Management plan should be prepared keeping the concerned quarry and the surrounding habitations in the mind.	Results of cumulative impact study due to mining operations are given in Section 7.4 under Chapter VII, pp.149-156.
19	Rain water harvesting management with recharging details along with water balance (both monsoon & non-monsoon) be submitted.	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.
20	Land use of the study area delineating forest area, agricultural land, gazing 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 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 has been discussed in Section 3.1, pp.35-45 under Chapter III. The details of surrounding sensitive ecological features are provided in Table 3.42 under Chapter III, p.103. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Table 2.8 under Chapter II, p.25.
21	Details of the land for storage of Overburden/Waste Dumps (or) Rejects outside the mine lease. such as extent of land area, distance from mine lease' its land use, R&R issues. If any, should be provided.	Not Applicable. No dumps have been proposed outside the lease area.
22	Proximity to Areas declared as 'Critically Polluted' (or) the Project areas which attracts the court restrictions for mining operations, should also be indicated and where so required' clearance certifications from the prescribed Authorities, such as the TNPCB (or) Dept. of Geology and Mining should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. This project area is involved in the production of rough stone and gravel materials as per the approved mine plan.

23	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.	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.
24	Impact on local transport infrastructure due to the Project should be indicated.	Impact on local traffic due to the project is within the permissible limit. Details are provided in Section 3.7, pp.101-103.
25	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.	A detailed tree survey was caried out within 300 m radius and the results have been discussed in Section 3.5 under Chapter III, pp.73-96.
26	A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific.	A progressive mine closure plan has been attached with the approved mining plan report in Annexure III. The budget details for the progressive mine closure plan are shown in Table 2.9 under Chapter II, p.25.
27	Public Hearing points raised and commitments 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 and to be submitted to SEIAA/SEAC with regard to the Office Memorandum of MoEF & CC accordingly.	The comments made in public hearing meeting will be updated in the final EIA report after public hearing meeting.
28	The Public hearing advertisement shall	Details of advertisement will be updated in

	be published in one major National daily and one most circulated vernacular daily.	the final EIA report.
29	The PP shall produce/display the EIA report, Executive summary and other related information with respect to public hearing in Tamil Language also.	The Tamil version of EIA report, executive summary and other related information will be incorporated in this report.
30	As a part of the study of flora and fauna around the vicinity of the proposed site, the EIA coordinator shall strive to educate the local students on the importance of preserving local flora and fauna by involving them in the study, wherever possible.	The EIA coordinator and the FAE for ecology and biodiversity visited the study area and educated the local students about the importance of protecting the biological environment.
31	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-I in consultation with the DFO, State Agriculture University and local school/college authorities. The plant species with dense/moderate canopy of native origin should be chosen. Species of small/medium/tall trees alternating with shrubs should be planted in a mixed manner.	A detailed Greenbelt Development Plan dealing with carbon sequestration has been provided in Section 4.6 under Chapter IV, pp.125-131.
32	Taller/one year old saplings raised in appropriate size of bags; preferably eco-friendly bags should be planted as per the advice of local forest authorities/ botanist/Horticulturist with regard to site	The FAE of ecology and biodiversity has advised the project proponent that saplings of one year old raised in the eco-friendly bags should be purchased and planted with the spacing of 3 m between each plant

	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	around the proposed project area as per the advice of local forest authorities/botanist. Saplings used for greenbelt development have been shown in Section 4.6 under Chapter IV, pp.125-131.
33	A Disaster management plan shall be prepared and included in the EIA/EMP Report for the complete life of the proposed quarry (or) till the end of the lease period.	The details about disaster management Plan have been provided in Section 7.3 under Chapter VII, pp.145-148.
34	A Risk Assessment and management plan shall be prepared and included in the EIA/EMP Report for the complete life of the proposed quarry (or) till the end of the lease period.	The details about risk assessment and management plan have been provided in Section 7.2 under Chapter VII, pp.142-144.
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational health impacts of the project and preventive measures have been discussed in detail in Section 4.8 under Chapter IV, pp.132 & 133.
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 are anticipated due to this project. Details of CSR and CER activities have been discussed in Sections 8.6 and 8.7 under Chapter VIII, pp.160 & 161.

37	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.	No negative impact on socio-economic environment of the study area is anticipated and this project shall benefit the Socio-Economic environment by offering employment for 19 people directly and 10 people indirectly as discussed in Section 8.1 and 8.2 under Chapter VIII, p.159.
38	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.
39	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.	Benefits of the project details have been given under Chapter VIII, pp.159-161.
40	If any quarrying operation were carried out in the proposed quarrying sile 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.	CCR will be submitted during appraisal of final EIA.
41	The PP shall prepare the EMP for entire life of mine and also furnish the sworn affidavit stating to abide the EMP for the entire life of mine.	A detailed EMP is provided in Table 10.9 & 10.10 under Chapter X, pp.174-180.
42	Concealing any factual information or	The EIA report has been prepared keeping

	submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this Terms of Conditions besides attracting penal provisions in the Environment (Protection) Act' 1986.		in mind the fact that concealing any factual information or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may lead to withdrawal of this terms of reference besides attracting penal provisions in the Environment (Protection) Act, 1986.
	Discussion by SEIAA and the Remarks:		
	The proposal was placed in the 616th Authority meeting held on 10.05.2023. The authority noted that this proposal was placed for appraisal in this 369th Meeting of SEAC held on 20.04.2023. After detailed discussions, the Authority accepts the recommendation of SEAC and decided to grant Terms of Reference (ToR) along with Public Hearing under cluster for undertaking the combined Environment Plan subject to the conditions as recommended by SEAC & normal conditions in addition to that the PP shall study about the following, From the uploaded by PP, it is ascertained that the proposed mining lease area is surrounded by agricultural activities and Veguthumalai RF is located at a distance of 340m from this area. Hence,		
1	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area covering the entire mine lease period as per precise area communication order issued from reputed research institutions on the following		
	a	Soil health	The result has discussed in the Chapter III, pp.34-106.
	b	Climate Change	
	c	Rise in Temperature	
	d	Water Table and drainage pattern	
	e	Agriculture	
	f	Wild life	
2	The PP shall obtain a letter from the Concerned Director of Agriculture stating that proposed mining activity has no impact on the surrounding Agriculture.		The letter will be provided in the final EIA report.

	Annexure 'B'	
1	Cluster Management Committee shall be framed which must include all the proponents in the cluster as members including the existing as well as proposed quarry.	A cluster management committee including all the proponents of the rough stone quarrying projects within the cluster of 500 m radius will be constituted for the effective implementation of green belt development plan, water sprinkling, blasting, etc.
2	The members must coordinate among themselves for the effective implementation of EMP as committed including Green Belt Development Water sprinkling, tree plantation, blasting etc.,	The members of the cluster management committee will be instructed to carry out EMP in coordination.
3	The List of members of the committee formed shall be submitted to AD/Mines before the execution of mining lease and the same shall be updated every year to the AD/Mines.	The list of members of the committee formed will be submitted to AD/Mines before the execution of mining lease.
4	Detailed Operational Plan must be submitted which must include the blasting frequency with respect to the nearby quarry situated in the cluster, the usage of haul roads by the individual quarry in the form of route map and network.	All the information has been discussed in Section 2.6 & 2.7 under Chapter II, pp.22-32.
5	The committee shall deliberate on risk management plan pertaining to the cluster in a holistic manner especially during natural calamities like intense rain and the mitigation measures considering the inundation of the cluster and evacuation plan.	It will be informed to the committee.
6	The Cluster Management Committee	The cluster management will be advised to

	shall form Environmental Policy to practice sustainable mining in a scientific and systematic manner in accordance with the law. The role played by the committee in implementing the environmental policy devised shall be given in detail.	practice sustainable mining in a scientific and systematic manner in accordance with the law. The role played by the committee in implementing the environmental policy devised will be given in detail.
7	The committee shall furnish action plan regarding the restoration strategy with respect to the individual quarry falling under the cluster in a holistic manner.	A proper action plan regarding the restoration will be followed by the committee.
8	The committee shall furnish the Emergency Management plan within the cluster.	The committee will submit the emergency management plan to the respective authority in the stipulated time period.
9	The committee shall deliberate on the health of the workers/staff involved in the mining as well as the health of the public.	The information on the health of the workers and the local people will be updated periodically.
10	The committee shall furnish an action plan to achieve sustainable development goals with reference to water, sanitation & safety.	A proper action plan with reference to water, sanitation & safety will be devised and submitted by the committee to the respective authority.
11	The committee shall furnish the fire safety and evacuation plan in the case of fire accidents.	The committee will submit the fire safety and evacuation plan as discussed in Section 7.3 under Chapter VII, pp.145-148.
Impact Study of mining		
12	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area covering the entire mine lease period as per precise area communication order issued from reputed research institutions on the following	

	a)	Soil health & soil biological, physical land chemical features.	The result has discussed in the Chapter III, pp.41-45
	b)	Climate change leading to Droughts, Floods etc.	The Study is under process. The results will be updated in the final EIA report.
	c)	Pollution leading to release of Greenhouse gases (GHG), rise in Temperature, & Livelihood of the local People.	
	d)	Possibi1ities of water contamination and impact on aquatic ecosystem health.	
	e)	Agriculture, Forestry, & Traditional practices.	
	f)	Hydrothermal/Geothermal effect due to destruction in the Environment.	
	g)	Bio-geochemical processes and its foot prints including environmental stress.	
	h)	Sediment geochemistry in the surface streams.	
Agriculture & Agro-Biodiversity			
13	Impact on surrounding agricultural fields around the proposed mining area.		As the proposed lease area is dominantly surrounded by mining land, barren land, and fallow land, the impact on the surrounding agricultural fields if present will be low. With proper mitigation measures, the project will be carried out to reduce the impact further to the level of negligence.
14	Impact on soil flora & vegetation around the project site.		Impact of the project on the ecology and biodiversity has been discussed in Section

		4.2 and Section 4.6 under Chapter IV, pp.108-109 and pp.125 - 131
15	Details of type of vegetations including no. of trees & shrubs within the proposed mining area shall be given and if so, transplantation of such vegetations all along the boundary of the proposed mining area shall committed mentioned in EMP.	Details of vegetation in the lease area have been provided in Section 3.5 under Chapter III, pp.73-96. Details about transplantation of plants have been provided in Section 4.6 under Chapter IV, pp.125-131
16	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.	The ecological details have been provided in Section 3.5 under Chapter III, pp.73-96.and measures have been provided in Section 4.6 under Chapter IV, pp.125-131
17	Action should specifically suggest for sustainable management of the area and restoration of ecosystem for flow of goods and services.	The FAE of ecology and biodiversity has advised the project proponent that replantation work, particularly for the project area where plants of 4 years old exist should be carried out in the vacant areas available.
18	The project proponent shall study and furnish the impact of project on plantations in adjoining patta lands, Horticulture, Agriculture and livestock.	The impact of project on the land environment has been discussed in Section 4.1 under Chapter IV, pp.107 & 108.
Forests		
19	The project proponent shall study on impact of mining on Reserve forests free ranging wildlife.	The impacts of the proposed project on the surrounding environment have discussed in Chapter IV, pp.107-135.
20	The Environmental Impact Assessment should study impact on forest,	The impacts of the project on ecology and biodiversity have been discussed in Section

	vegetation, endemic, vulnerable and endangered indigenous flora and fauna.	4.6 under Chapter IV, pp.125-131.
21	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection.	The impacts of the project on standing trees and the existing trees have been discussed in Section 4.6 under Chapter IV, pp.125-131.
22	The Environmental Impact Assessment should study impact on protected areas, Reserve Forests, National parks, corridors and wildlife pathways, near project site.	There are no protected areas, National Parks, Corridors and Wildlife pathways near project site. The list of environmentally sensitive areas within 10 km radius has been provided in Table 3.42 under Chapter III, p.103.
Water Environment		
23	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 1 km (radius) so as to assess the impacts on the nearby waterbodies due to mining activity. 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, covering the entire mine lease period.	A detailed hydrogeological study was carried out. The results have been discussed in Section 3.2 under Chapter III, pp.46-58.
24	Erosion Control Measures.	Garland drainage structures will be constructed around the lease area to control the erosion, as discussed in Section 4.3 under Chapter IV, pp.109 & 110.

25	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area on the nearby villages, waterbodies/rivers & any ecological fragile areas.	A detailed study was carried out regarding the impact of mining on the environment. The results have been included in Chapter IV, pp.107-135.
26	The project proponent shall study impact on fish habitats and the food WEB/food chain in the water body and Reservoir.	As there are no water bodies near to the proposed project site during study period, a study about the impact of mining on fish habitats was not conducted.
27	The project proponent shall study and furnish the details on potential fragmentation impact on natural environment, by the activities.	The impacts of the proposed project on the surrounding environment have discussed in Chapter IV, pp. 107-135.
28	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 sits possible land form changes visual and aesthetic impacts.	The impact of the proposed project on aquatic plants and animals in water bodies has been discussed in Section 4.6 under Chapter IV, pp.125-131.
29.	The Terms of Reference should specifically study impact on soil health, soil erosion, the soil physical, chemical components.	The impact of mining on soil environment has been discussed in Section 4.2 under Chapter IV, pp.108-109.
30	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	The impacts on water bodies, streams, lakes have been discussed in Section 4.3 under Chapter IV, pp.109 & 110.
Energy		
31	The measures taken to control Noise, Air, water, Dust control and steps adopted to efficiently utilise the Energy shall be	The measures taken to control Noise, Air, water, and dust have been given under Chapter IV, pp.107-135.

	furnished.	
Climate Change		
32	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.	Greenbelt development plan as discussed in Section 4.6 under Chapter IV has been designed to reduce the impact of carbon emission on the environment, pp.125 – 131.
33	The Environmental Impact Assessment should study impact on climate change, temperature rise, pollution and above soil & below soil carbon stock.	The information will be included in the final EIA report.
Mine Closure Plan		
34	Detailed Mine closure plan covering the entire mine lease period as per precise area communication order issued.	A progressive mine closure plan has been attached with the approved mining plan report in Annexure III. The budget details for the mine closure are shown in Table 2.9 under Chapter II, p.25.
EMP		
35	Detailed Environment Management plan along with adaptation, mitigation & remedial strategies covering the entire mine lease period as per precise area communication order issued.	A detailed Environment Management plan has been given under Chapter X, pp.163-180.

36	The Environmental Impact Assessment should hold detailed study on EMP with budget for green belt development and mine closure plan including disaster management plan.	A detailed Environment Management plan has been given in Tables 10.9 & 10.10 under Chapter X, pp.174-180.
Risk Assessment		
37	To furnish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	The risk assessment and management plan for this project has been provided in Section 7.2 under Chapter VII, pp.142-144.
Disaster Management Plan		
38	To furnish disaster management plan and disaster mitigation measures in regard to all aspects to avoid/reduce vulnerability to hazards & to cope with disaster/untoward accidents in & around the proposed mine lease area due to the proposed method of mining activity & its related activities covering the entire mine lease period as per precise area communication order issued.	A detailed Environment Management Plan has been given under Chapter X, pp.163-180.
Others		
39.	The project proponent shall furnish VAO certificate with reference to 300 m radius regard to approved habitations, schools, Archaeological sites, structures, railway lines, roads, water bodies such as streams, odai, vaari, canal, river, lake pond, tank etc.	The VAO certificate of 300 m radius is provided in the Annexure.

40	As per the MoEF & CC office memorandum F.No.22-65/2017-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 pan.	The response to comments will be given final EIA report.
41	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.	The matter on plastic waste management has been given in Section 7.5 under Chapter VII, pp.156 – 157.
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.
2.	A copy of the document in support of the fact that the proponent is the rightful lessee of the mine should be given.	The proposed site for quarrying is a patta land. A copy of the ownership document has been enclosed along with the approved mining plan in Annexure III
3.	All documents including approved mine	The following will approve mine plan, EIA

	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.	and public hearing will submitted in the final EIA report.
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).	All corner coordinates of the mine lease area have been superimposed on a high-resolution Google Earth Image, as shown in Figure 2.4, under Chapter II, p-15.
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.	The baseline data sampling locations for all the environmental components are shown in Survey of India Toposheet under Chapter III
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 lease 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	The proponent has framed Environmental Policy and the same has been discussed in Section 10.1 under Chapter X, pp.163 & 164.

	out in the EIA Report with description of the prescribed operating process/ procedures to bring into focus any infringement/ deviation/ violation of the environmental or forest norms/conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the 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 Manual 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	All the data contained in the EIA report such as waste generation etc., is for the life of the mine / lease period.

	be for the life of the mine / lease period.	
10.	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	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 has been discussed in Section 3.1 under Chapter III, pp.35-45. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Table 2.8 under Chapter II, p.25.
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 need customers. Hence, no dumps are 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	Not Applicable. There is no forest land involved within the proposed project area and the proposed project area is a patta land.

	Department to assist the Expert Appraisal Committees.	
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. There are neither forests nor forest dwellers/forest dependent communities in the mine lease area. There is no forest impacted families (PF) or people (PP). Thus, the rights of Traditional Forest Dwellers will not be compromised on account of the project.
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 as there are neither forests nor forest dwellers / forest dependent communities in the mine lease area. There shall be no forest impacted families (PF) or people (PP). Thus, the rights of Traditional Forest Dwellers will not be compromised on account of the project.
15.	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	Details about forest vegetation have been provided in Section 3.5 under chapter-III, pp.73-96.
16.	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	A study was done on wildlife within the study area, as shown in Section 3.5 under chapter-III, pp.73-96. The impact on wild life has been discussed in Section 4.6 under Chapter IV, pp.125-131.
17.	Location of National Parks, Sanctuaries,	Information regarding the same has been

	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	given in Table 3.42 under Chapter III, p.103.
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.	A detailed biological study was carried out in both core and buffer zones and the results have been discussed in Section 3.5 under chapter-III, pp.73-96. There is no schedule I species of animals observed within study area as per Wildlife Protection Act, 1972 and no species falls 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	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.

	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 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 the period of March – May2023, as per CPCB notification and MoEF & CC Guidelines. Primary baseline data and the results have been included in Sections 3.1-3.7 under Chapter III, pp. 35-103.
23.	Air quality modelling should be carried	Air quality modelling for prediction of

	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.	incremental GLCs of pollutants was carried out using AERMOD view. The model results have been given in Section 4.4 under the Chapter IV, pp.110-120.
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.	The water requirement for the project, its availability and source have been provided in Table 2.11 under Chapter II, p.31.
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	Part of the working pit will be allowed to collect rain water during the spell of rain. The water thus collected will be used for greenbelt development and dust

	Project, if any, should be provided.	suppression. The mine closure plan will be 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 were conducted and the results have been discussed in Section 4.3, under the Chapter IV, pp. 109 & 110.
28.	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect 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.	Not Applicable. The ground water table is found at the depth of 60 m below ground level. The ultimate depth of quarry is 30 m BGL. Therefore, the mining activity will not intersect the ground water table. Data regarding the occurrence of groundwater table have been provided in Section 3.2 under Chapter III, pp.46-58.
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	Not Applicable. There are no streams, seasonal or other water bodies passing within the project area. Therefore, no modification or diversion of

	hydrology should be brought out.	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.	The highest elevation of the project area is 211 m AMSL. Ultimate depth of the mine is 30 m BGL. Depth to the water level in the area is 60 m 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.	A detailed Greenbelt Development Plan has been provided in Tables 4.14 and 4.15 in Section 4.6 under Chapter IV, pp.125-131.
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,	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 have been provided in

	indicating whether it is capable of handling the incremental load. Arrangem ent 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.	Section 3.7 under Chapter III, pp.101-103.
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 Section 2.6.7 under Chapter II, p.31.
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.	Progressive mine closure plan has been prepared for this project and is given in Section 2.6 under Chapter II, pp.22-32.
35.	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational health impacts of the project and preventive measures have been explained in detail in Section 4.8 under chapter IV, pp.132 & 133.
36.	Public health implications of the Project and related activities for the population in	No public health implications are anticipated due to this project. Details of

	the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	CSR and CER activities have been discussed in Sections 8.6 and 8.7 under Chapter VIII, pp.160 & 161.
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 of the study area is anticipated and this project shall benefit the Socio-Economic environment by offering employment for 19 people directly and 10 people indirectly, as discussed in Section 8.1 under Chapter VIII, p.160.
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 has been provided under Chapter X, pp.163-180.
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 details will be updated in the final EIA report after public hearing meeting.
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	Project Cost is Rs. 56,55,300/- In order to implement the environmental

	towards implementation of EMP should be clearly spelt out.	protection measures, an amount of Rs.2970454 as capital cost and recurring cost as Rs.1588936 as recurring cost/annum is proposed considering present market price considering present market scenario for the proposed project. After the adjustment of 5% inflation per year, the overall EMP cost for 5 years will be Rs.11818840, as shown in Tables 10.9 &10.10 under Chapter X, pp.174-180.
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	The details have been provided in Section 7.2 under Chapter VII, pp.142-144.
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.	Benefits of the project have been discussed under Chapter VIII, pp.159-161.
44.	Besides the above, the below mentioned general points are also to be followed:	
a)	Executive Summary of the EIA/EMP Report	Executive summary has been enclosed as a separate booklet.
b)	All documents to be properly referenced with index and continuous page numbering.	All the documents have been 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 have been mentioned.
d)	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF & CC/NABL	Original Baseline monitoring reports will be submitted in the final EIA report during appraisal.

	accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project	
e)	Where the documents provided are in a language other than English, an English translation should be provided.	All the documents provided here are in English language.
f)	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	The questionnaire 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. No. J-11013/41/2006-IA. II(I) dated 4th August, 2009, which are available on the website of this Ministry, should be followed.	Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IA. II (I) dated 4th August, 2009 have been followed while preparing the EIA report.
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.	No changes are made in the basic scope and the project parameters.
i)	As per the circular no. J-11011/618/2010-IA. II(I) Dated:	The certified compliance report will be provided in the final EIA report.

	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.	
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.	All the plans related to mining have been included along with the approved mining plan report in Annexure.

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CHAPTER I

INTRODUCTION

1.0 PREAMBLE

Environmental Impact Assessment (EIA) study is a process used to identify the environmental, social and economic impacts of a project prior to decision-making. EIA systematically examines both beneficial and adverse consequences of the proposed project and ensure that these impacts are considered during the project designing. According to the Ministry of Environment and Forests, Govt. of India, 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, all the mining projects are broadly classified into two categories, i.e., category A and category B, based on the spatial extent of the projects. The category B projects are further divided in to B1 and B2 on the basis of the guidelines issued of the Ministry of Environment and Forests. All mining projects included in category B1 require an EIA report for obtaining environmental clearance from the State Environment Impact Assessment Authority (SEIAA). As the proposed project falls within the cluster of quarries of overall extent of greater than 5 ha and less than 50 ha in the case of non-coal mine lease, the proposed project falls under the category B1 and the project requires preparation and submission of an EIA report after public consultation to SEIAA for obtaining environmental clearance 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.

In compliance with ToR obtained vide Letter No. SEIAA-TN/F.No.9858/SEAC/ToR-1441/2023 Dated 10.05.2023, this EIA report has been prepared for the project proponent, Thiru.B.Karuppaiah applied for rough stone and gravel quarry lease in the Patta land falling in S.F.No.1193/1, 1193/2, 1199/1B, 1199/1C, 1199/1D, 1199/1E, 1199/1F, 1199/1H, 1199/1I, 1199/1J & 1199/1K over an extent of 2.01.5 ha in Katchaikatti Village, Vadipatti Taluk, Madurai District and Tamil Nadu. This EIA report takes into account the rough stone quarries within the cluster of 500 m radius from the periphery of the proposed project site. The cluster contains four proposed project, known as P1, P2, P3 and P4 and one existing project known as E1 and two expired project EX1 and EX2.All the projects mentioned above have been taken for cluster extent calculation as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016. The total extent of all the quarries is 13.57.0 ha, also known as the cluster extent. The quarries involved in the calculation of cluster extent are shown in Figure 1.1.

Table 1.1 Details of Quarries within the Cluster Area of 500 m Radius

Proposed Quarries					
Code	**Name of the Owner**	**S.F. No**	**Village**	**Extent (ha)**	**Status**
P1	Thiru.B.Karuppaiah	1199/1B, 1199/1C, 1199/1D, 1199/1E, 1199/1F, 1199/1H, 1199/1I, 1199/1J, 1199/1K, 1193/1, 1193/2	Katchaikatti	2.01.5	Proposed Area
P2	Thiru.A.D. Meenatchi Sundaram	168/25 (0.58.5), 1171/3 (0.84.0), 1171/5 (0.19.5)	Katchaikatti	1.62.0	Applied Area
P3	Thiru.R.Kannan	1168/7 (0.65.0), 1168/9 (0.90.5), 1168/19 (0.35.5)	Katchaikatti	1.91.0	Applied Area
P4	M/s. Concretia Rock Product (Pvt) Ltd	1185/1 (0.85.0), 1185/7A (0.66.5), 1185/8 (0.28.0)	Katchaikatti	1.79.5	Applied Area
Existing Quarry					
E1	Thiru.Inbaraj.M	1135/7 (0.21.5), 1159/2A (0.91.5), 1159/3 (0.16.0), 1159/4 (0.08.0), 1159/5 (0.06.5), 1159/6 (0.08.0), 1216/1 (0.44.0), 1216/2 (0.26.0), 1138 (0.52.0),	Katchaikatti	3.66.0	20.09.2019 to 19.09.2024

		1135/1A2 (0.09.0), 1135/1B2 (0.13.5), 1135/2B (0.23.5), 1135/5 (0.26.5), 1135/6 (0.20.0)			
Expired Quarries					
EX1	Tmt.Selvi.G	1169/6B (0.12.5), 1169/6I (0.10.5), 1169/6J (0.10.5), 1169/6K (0.19.0), 1169/6L (0.06.5), 1169/6M (0.08.0)	Katchaikatti	0.67.0	10.04.2017 to 09.04.2022
EX2	Thiru,Rajesh	1185/2 (0.25.0), 1185/3 (0.39.0), 1185/4 (0.20.0), 1185/5 (0.19.5), 1185/6 (0.15.5), 1185/7B (0.71.0)	Katchaikatti	1.90.0	28.08.2017 to 27.08.2022
	Total Cluster Extent			**13.57.0**	---

Source:

AD Letter - Roc.No.831/Mines/2022-2, Dated:08.02.2023.

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

1.1 PURPOSE OF THE REPORT

The purpose of the report is to study baseline environmental conditions in and around the proposed project area for the period of **March-May 2023** according to the provisions of MoEF & CC Office Memorandum dated 29.08.2017 and MoEF & CC Notification, S.O. 996 (E) dated 10.04.2015, to analyse impacts and provide mitigation measures.

1.2 ENVIRONMENTAL CLEARANCE

The Environmental Clearance process for the project will comprise of four stages. These stages are screening, scoping, public consultation & appraisal.

Screening

Screening is the first stage of the EIA process. In this stage, the State level Expert Appraisal Committee (SEAC) examined the application of EC made by the proponent in Form 1 through online (Proposal No. SIA/TN/MIN/419463/2023 Dated 25.02.2023) and decided that the project requires detailed environmental studies for the preparation of EIA report. Therefore, the proponent submitted application for Terms of Reference (ToR) on 28.02.2023.

Scoping

The proposal was placed in the 369th meeting of SEAC on 20.04.2023. Based on the presentation and documents furnished by the project proponent, SEAC decided to recommend the proposal for the grant of Terms of Reference (ToR) and the recommendation for ToR is subjected to the outcome of the Honourable NGT, Principal Bench, New Delhi (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.102/2017 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).

Public Consultation

In this stage, an application along with the draft of EIA and EMP report will be made to the Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing ensuring public participation at the project site or in its close proximity in the district. During public hearing, an opportunity will be given to the people living nearby the project site to express their opinions about the impact of the proposed project on the environment. The outcome of the public hearing meeting will be updated in the final EIA report for appraisal.

Appraisal

In this stage, an application along with final EIA report including the outcome of the public consultations will be made to the SEIAA. The application thus made will be scrutinized by the SEAC. Then, the SEAC will make recommendations to grant EC or reject the application to the SEIAA.

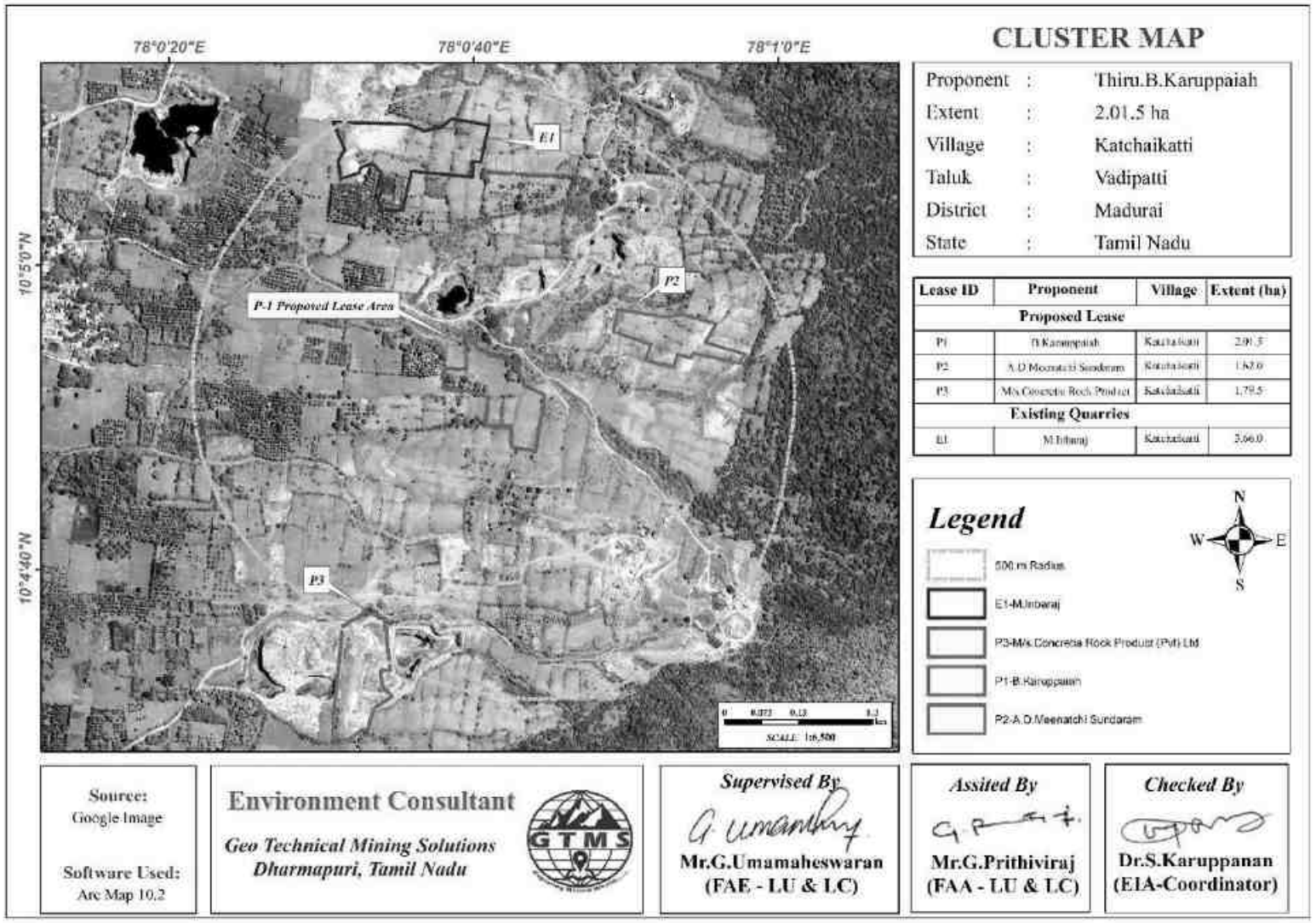


Figure 1.1 Location of the proposed and existing rough stone quarries in the cluster of 500 m radius

1.3 TERMS OF REFERENCE (ToR)

The SEAC framed a comprehensive Terms of Reference (ToR) based on the information provided in the Form 1 and information collected from the proposed project site visit and issued ToR to the proponent vide Letter No: SEIAA-TN/F.No.9858/SEAC/ToR-1441/2023 Dated:10.05.2023 for the preparation of an EIA report.

1.4 POST ENVIRONMENT CLEARANCE MONITORING

For category B projects, irrespective of its clearance by MoEF/SEIAA, the project proponent shall prominently advertise in the newspapers indicating that the project has been accorded environmental clearance and the details of MoEF website where it is displayed.

After obtaining EC, the project proponent will submit a half-yearly compliance report of stipulated environmental clearance terms and conditions to MoEF & CC Regional Office & SEIAA on 1st June and 1st December of every year.

1.5 TRANSFERABILITY OF ENVIRONMENTAL CLEARANCE

A prior environmental clearance granted for a specific project or activity to an applicant may be transferred during its validity to another legal person entitled to undertake the project or activity on application by the transferor or the transferee with a written "no objection" by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which the prior environmental clearance was initially granted, and for the same validity period (EIA Guidance Manual for Mining of Minerals, 2010).

1.6 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. The generic structure of the EIA document should be as under:

- Introduction
- Project Description
- Description of the Environment
- Anticipated Environmental Impact & Mitigation Measures
- Analysis of Alternatives (Technology & Site)
- Environmental Monitoring Program
- Additional Studies
- Project Benefits
- Environmental Cost Benefit Analysis
- Environmental Management Plan (EMP)
- Summary & Conclusion
- Disclosure of Consultants engaged.

1.7 IDENTIFICATION OF THE PROJECT PROPONENT

The profile of the project proponent who has involved in this quarrying project has been given in Table 1.2.

Table 1.2 Details of Project Proponent

Name of the Project Proponent	Thiru. B. Karuppaiah
Address	S/o.Bose, No. 209 A, Vilakkulam, Puliyangulam, Melapidayur, Sivagangai District - 630606
Status	Proprietor.

1.8 BRIEF DESCRIPTION OF THE PROJECT

The proposed project deals with excavation of rough stone and gravel which is primarily used in construction projects. The method adopted for rough stone and gravel excavation is Open Cast- Semi Mechanized mining method involving formation of benches with 5 m height and 5 m width. The proposed project site is located in Katchaikatti Village, Vadipatti Taluk, Madurai District, and Tamil Nadu State. Some of the important features of the proposed project have been provided in Table 1.3.

Table 1.3 Salient Features of the Proposed Project

Name of the Quarry	Mr.B.Karuppaiah Rough Stone and Gravel Quarry
Type of Land	Patta Land
Extent	2.01.5 ha
S.F. No	1193/1,1193/2,1199/1B,1199/1C,1199/1D, 1199/1E,1199/1F,1199/1H,1199/11,1199/1J & 1199/1K.
Toposheet No	58-J/04
Latitude	10°4’47.79’’N to 10°4’55.37’’N
Longitude	78°0’37.99’’E to 78°0’44.65’’E
Highest Elevation	211 m AMSL

Ultimate depth of Mining	20 m BGL	
Geological Resources	Rough Stone in m^3	Gravel in m^3
	568120	40580
Mineable Reserves	Rough Stone in m^3	Gravel in m^3
	184603	27862
Proposed reserves for five years	Rough Stone in m^3	Gravel in m^3/2 years
	156188	27862
Method of Mining	Open-Cast Semi Mechanized mining	
Topography	Flat Terrain	
Machinery proposed	Jack Hammer	3
	Compressor	1
	Tipper	4
	Excavator	1
Blasting Method	The quarrying operation is proposed to carried out by open cost, using jack hammer drilling followed by manual breaking will be adopted to release the rough stone and nonel blasting is proposed in this lease area.	
Proposed Manpower Deployment	19 Nos	
Project Cost	Rs.56,55,300/-	
CER Cost @ 2% of Project Cost	Rs. 5,00,000/-	
Proposed Water Requirement	5.9 KLD	

1.9 SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact of the quarries in the cluster on the study area and formulate the effective mitigation measures for each individual lease. 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, and dust generation has been provided in this report. The baseline monitoring study has been carried out during the period of **March-May 2023** for various environmental components such as land, soil, air, water, noise, ecology, etc. 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. The sampling methodologies for the various environmental parameters required for the study, frequency of sampling, method of sample analysis, etc., are given in Table 3.1 in chapter III.

1.10 REFERENCES

The report has been prepared using the following references:

- Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, February, 2010
- EIA Notification, 14th September, 2006
- Terms of Reference (ToR) issued by SEIAA.
- Approved Mining Plan of this Project.
- The Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention and Control of Pollution) Act, 1981
- The Environment (Protection) Act, 1986
- The Forest (Conservation) Act, 1988
- The Wildlife (Protection) Act, 1972.

CHAPTER II

PROJECT DESCRIPTION

2.0 GENERAL INTRODUCTION

The open cast mining method, also known as open-pit mining has been proposed to extract the mineral deposit. It is the most commonly used surface mining method all over the world and is generally suitable for mining low-grade mineral deposits that are found close to the surface of the earth and distributed uniformly over a large area. Open pits are also termed quarries when the pits are used for the extraction of building materials and dimension stones.

Opencast mining starts with the development of benches, the widths of which will be determined in such a way to accommodate the use of heavy machinery. The walls of open pits will be dug at an angle that will be decided based on well-established industry standards to provide safety. In some cases where the walls are composed of weak material such as soil and highly weathered rocks, dewatering holes will be drilled horizontally to relieve the water pressure to avoid wall collapse inside the mine site.

The required mine-related infrastructures will be established close to the open pit. The mining infrastructures may include an administration building, a maintenance garage, and a warehouse. The materials mined from open pits will be brought to the surface using trucks. The waste rocks will be piled up in a suitable location, usually close to the open pit. The structure produced by the waste rock pile is known as a waste dump. The dimension of the waste dump will be determined based on industrial safety standards to prevent the rocks from falling into the surrounding area.

2.1 DECSCRIPTION OF THE PROJECT

The proponent, **Mr. B. Karuppaiah** is involved in the undertaking of establishment, construction, development, and closure of opencast mines. He, through the exploration phase, identified the proposed project site as the one that has a great potential of producing an economically viable quantity of rough stone and gravel. Therefore, the proponent had applied for quarry lease on 28.04.2022 to extract rough stone. The precise area communication letter was issued by Department of Geology and Mining, Madurai vide Rc.No.831/Mines/2022, dated:05.01.2023. Based on the precise area communication letter, mining plan was prepared. The mining plan thus prepared was approved by Assistant Director Department of Geology and Mining, Madurai Roc.No.831/Mines/2022-2, dated:08.02.2023. The overall view of the project site is shown in Figure 2.1.

Figure 2.1 Overall View of Proposed Project Site

2.2 LOCATION AND ACCESSIBILITY

The proposed quarry project is located in Katchaikatti Village, Vadipatti Taluk, Madurai District, as shown in Figure 2.2 & 2.3. The area lies between Latitudes from 10°4'47.79"N to 10°4'55.37"N and Longitudes from 78°0'37.99"E to 78°0'44.65"E. The maximum altitude of the project area is 211 m AMSL. Accessibility details to the proposed project site have been given in Table 2.1.

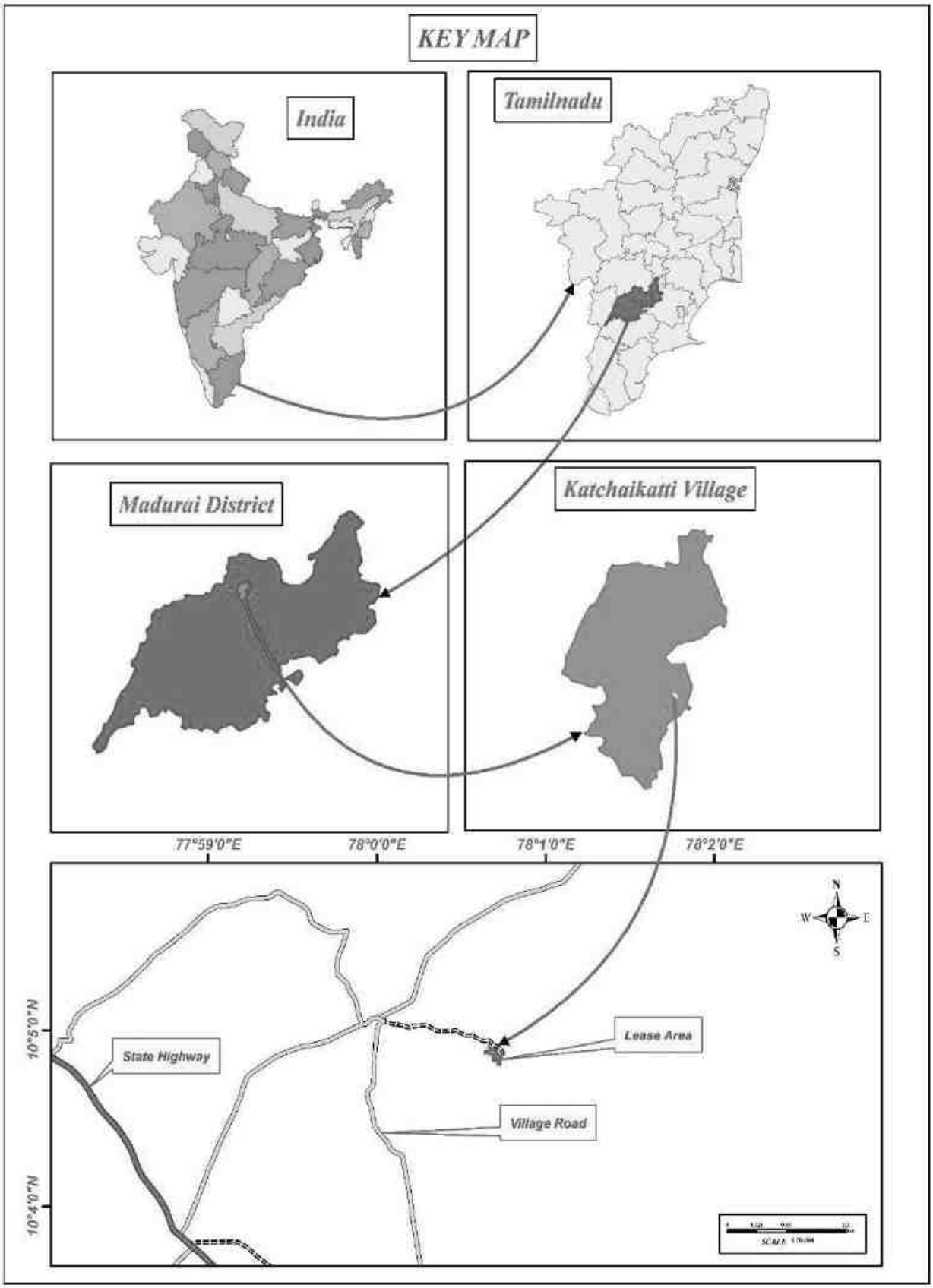


Figure 2.2 Key Map Showing Location of the Project Site

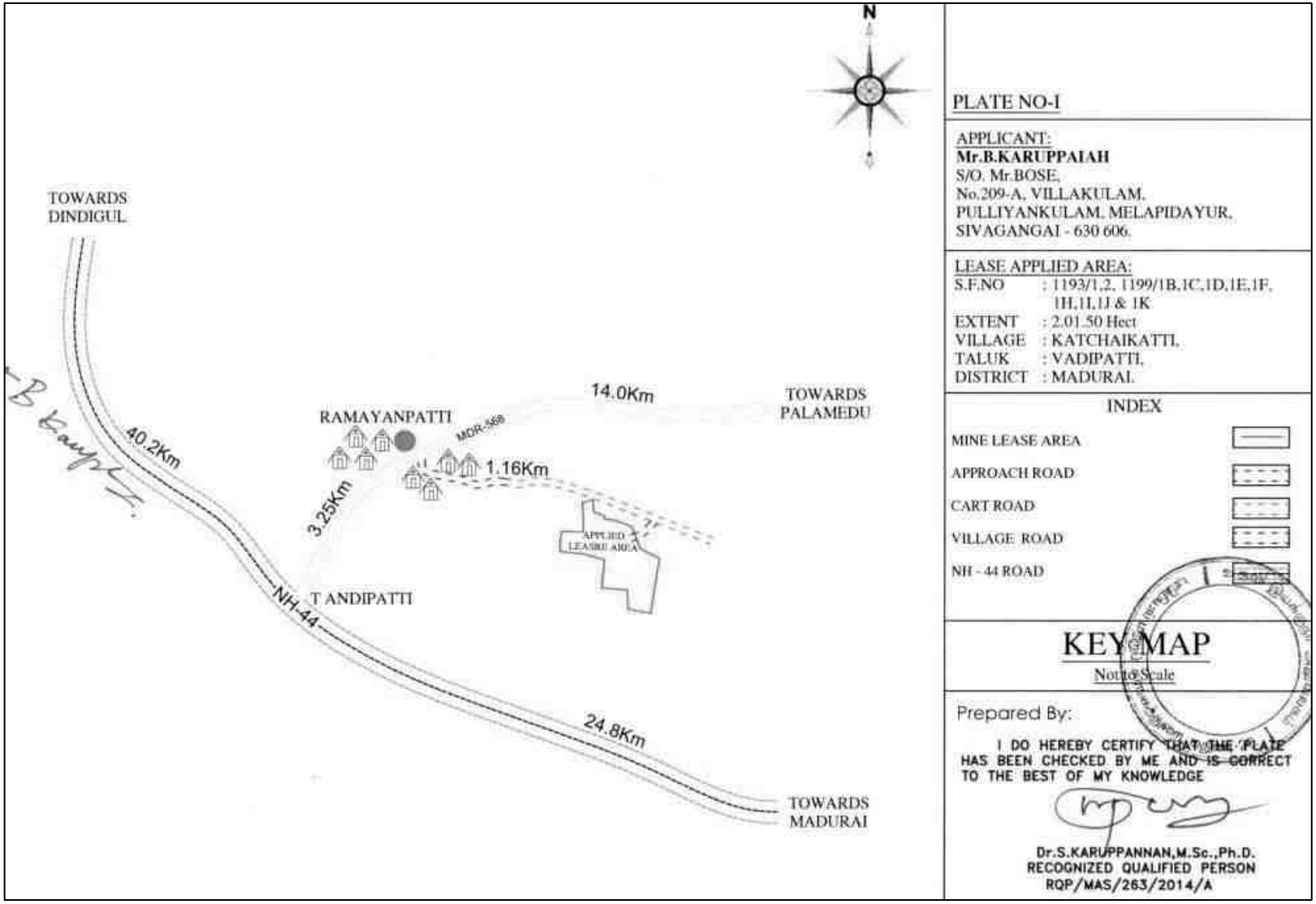


Figure 2.3 Site Connectivity to the Lease Area

Table 2.1 Site Connectivity to the Project Area

Nearest Roadways	MDR – 568 Vadipatti - Palamedu	1 km W
Nearest Town	Vadipatti	4.2 km W
Nearest Railway Station	Madurai	45.0 km SW
Nearest Airport	Madurai	60 km SW
Nearest Seaport	Thoothukudi	200 km S
Nearest Villages	Kutladampatti	1.75 km N
	Poochampatti	1.39 km S
	Ramayanpatti	0.94 km E
	Kuttimeykipatti	5.0 km W

2.3 LEASEHOLD AREA

- The extent of the proposed project site is 2.01.5 ha.
- The proposed project is site specific.
- There is no mineral beneficiation or processing proposed inside the project area.
- There is no forest land involved in the proposed area and is devoid of major vegetation and trees.

2.3.1 Corner Coordinates

The boundary corner geographic coordinates are given in Table 2.2 and the proposed project site with boundary coordinates has been shown in Figure 2.4 & 2.5.

Table 2.2 Corner Coordinates of Proposed Project

Pillar ID	Latitude	Longitude	Pillar ID	Latitude	Longitude
1	10° 4'55.37"N	78° 0'40.14"E	12	10° 4'49.50"N	78° 0'40.73"E
2	10° 4'54.54"N	78° 0'40.20"E	13	10°4'51.33"N	78° 0'40.96"E
3	10° 4'54.28"N	78° 0'40.90"E	14	10° 4'51.72"N	78° 0'39.60"E
4	10° 4'54.07"N	78°0'40.93"E	15	10° 4'51.89"N	78°0'37.99"E
5	10° 4'53.99"N	78° 0'41.68"E	16	10° 4'52.59"N	78° 0'38.00"E
6	10° 4'53.59"N	78° 0'42.74"E	17	10° 4'53.23"N	78° 0'38.10"E
7	10°4'52.10"N	78° 0'43.33"E	18	10° 4'53.19"N	78° 0'39.53"E
8	10°4'51.47"N	78° 0'44.65"E	19	10° 4'54.37"N	78° 0'39.54"E
9	10°4'47.79"N	78° 0'44.07"E	20	10° 4'54.79"N	78° 0'39.48"E
10	10° 4'48.08"N	78° 0'42.54"E	21	10° 4'55.14"N	78° 0'39.45"E
11	10° 4'49.36"N	78° 0'42.48"E	-	-	-

2.4 GEOLOGY

The lease area geologically occurs in Acid to Intermediate Charnockite. The Charnockite, commercially called as Roughstone occurs within the migmatite rock. Also, the lease area geomorphologically occurs over pediment pediplain complex.

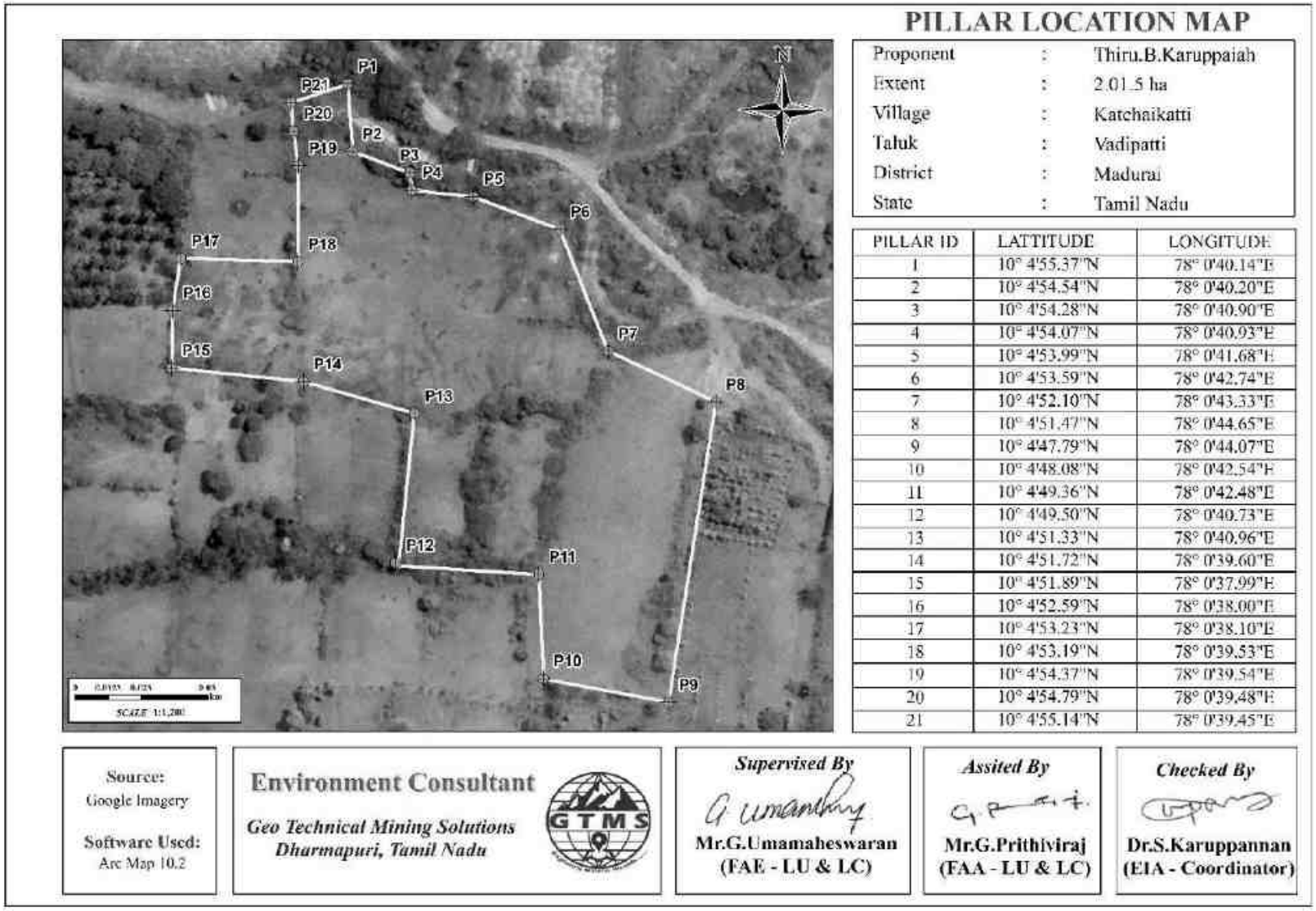


Figure 2.4 Pillar Location Map

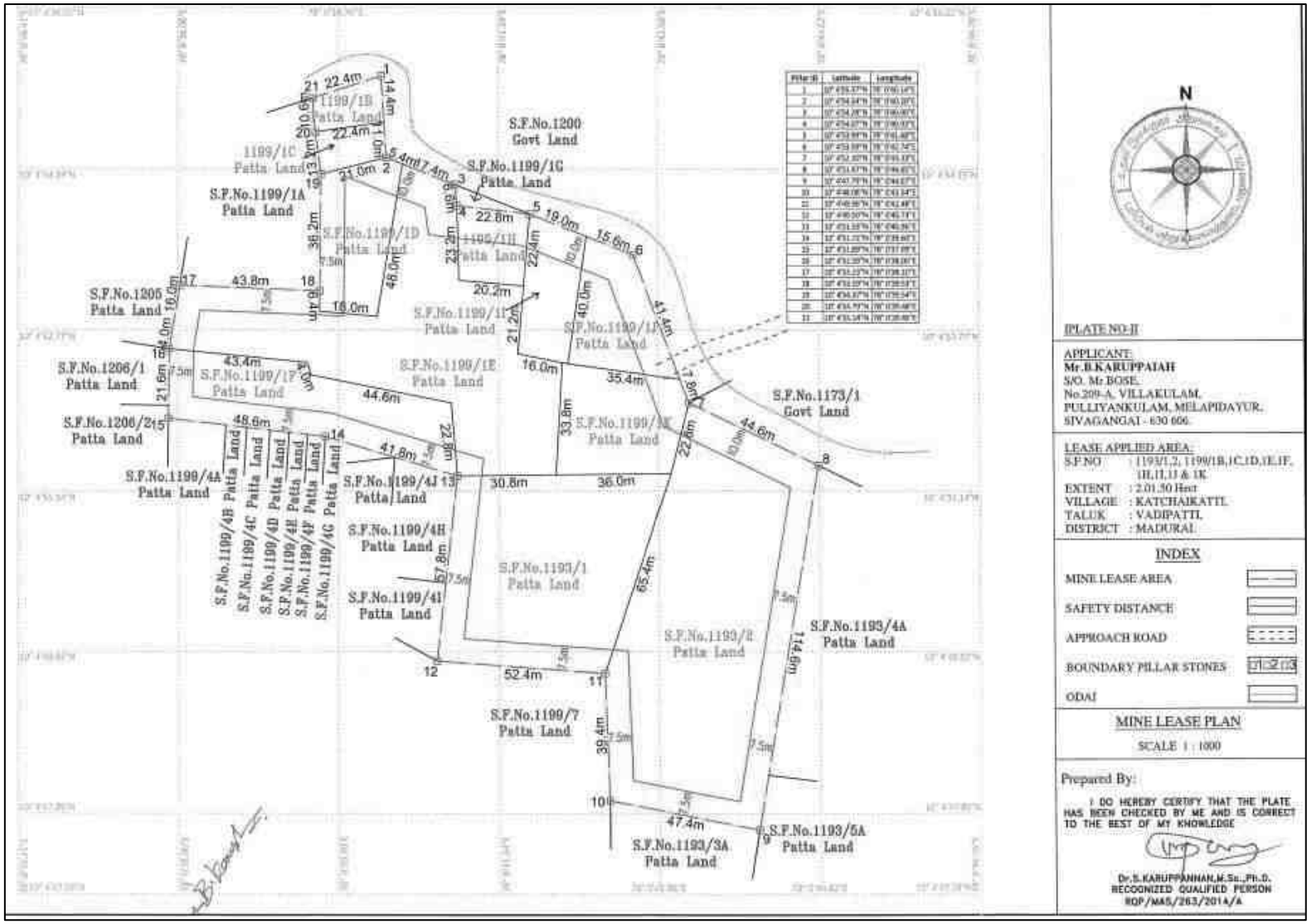


Figure 2.5 Mine Lease Plan

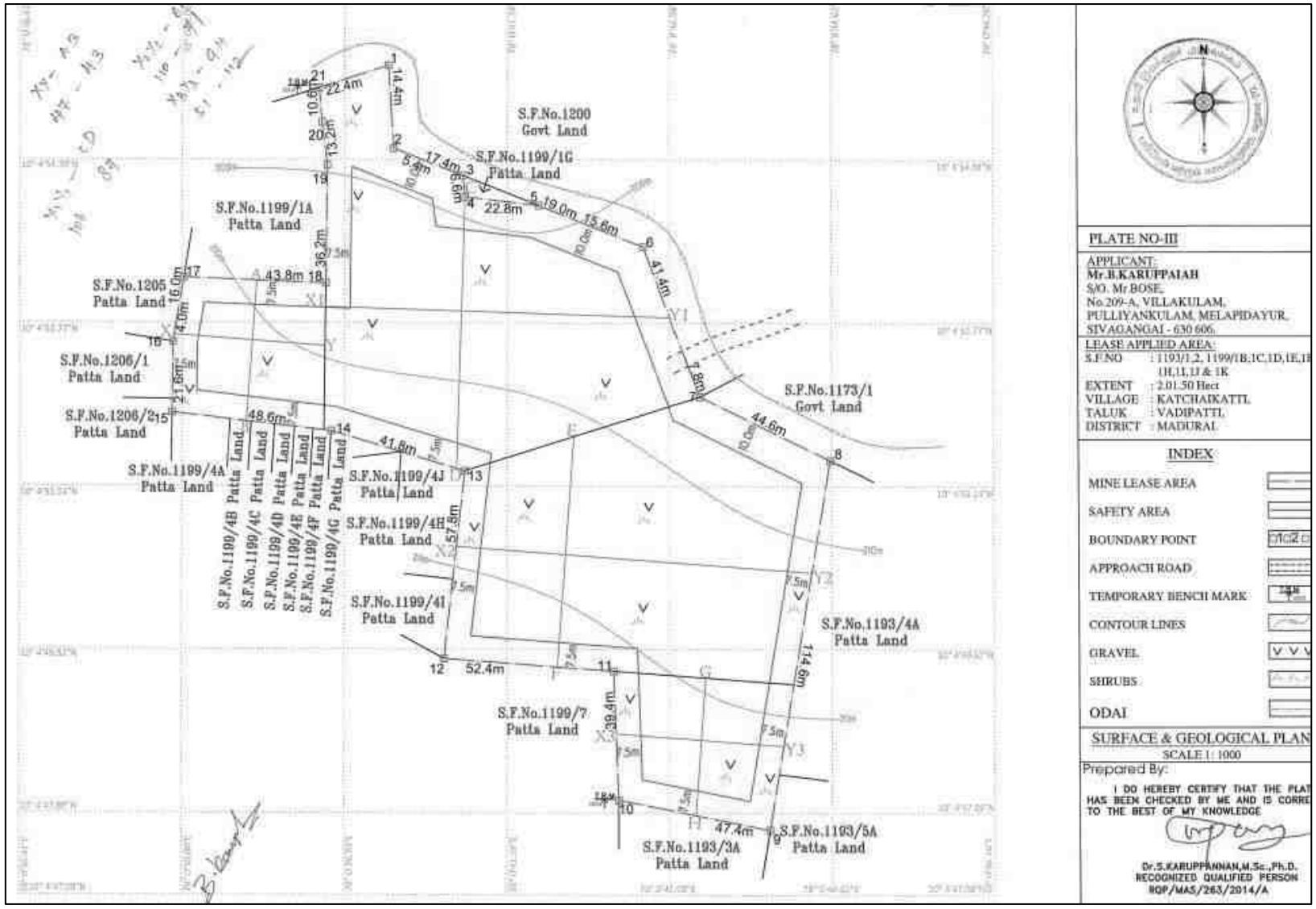


Figure 2.6 Surface and Geological Plan

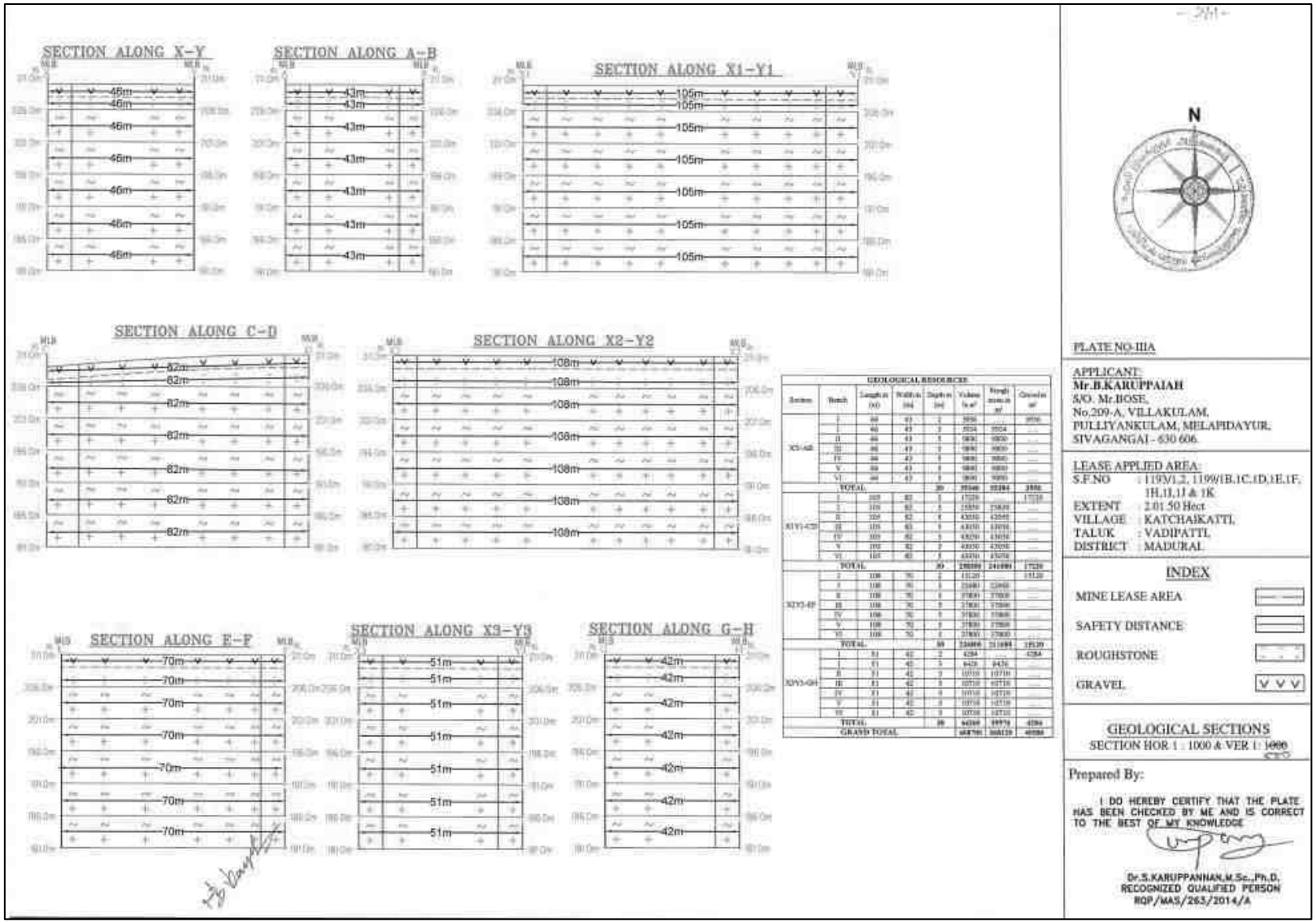


Figure 2.6a Geological Sections

2.5 QUANTITY OF 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 the proposed project. 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 7.5 m and 10 m safety distance as per precise area communication letter and deducting the locked-up reserves during bench formation (also called as Bench Loss). The mineable reserves are calculated up to the depth of 20 m considering there is no waste / overburden / side burden (100% Recovery anticipated) for the proposed project. The plate used for reserve estimation has been shown in Figure 2.6 & 2.6a and results of geological resources and reserves have been shown in Table 2.3.

Table 2.3 Estimated Resources and Reserves of the Project

Resource Type	Rough Stone in m^3	Gravel in m^3
Geological Resource in m^3	568120	40580
Mineable Reserves in m^3	184603	27862
Proposed production for 5 years m^3	156188	27862

Based on the year wise development and production plan and sections, the year wise production results have been given in Table 2.4 & Figure 2.7 and Figure 2.7a.

Table 2.4 Year-Wise Production Details

Year	Rough Stone in (m^3)	Gravel in (m^3)
I	32296	13624
II	34007	14238
III	27970	--
IV	34645	--
V	27270	--
Total	**156188**	**27862**

Source: Approved Mining Plan & Tor

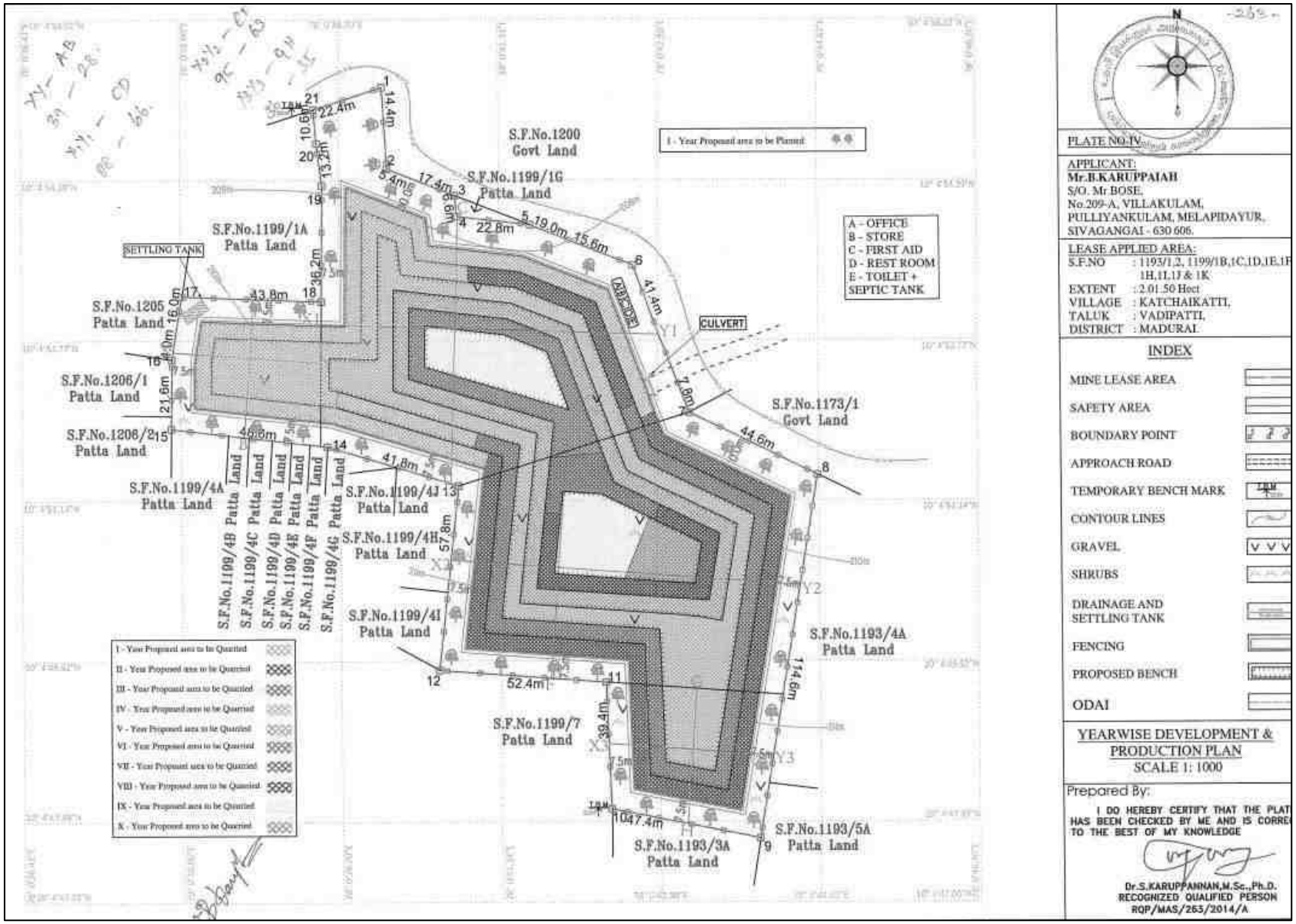


Figure 2.7 Yearwise Development & Production Plan

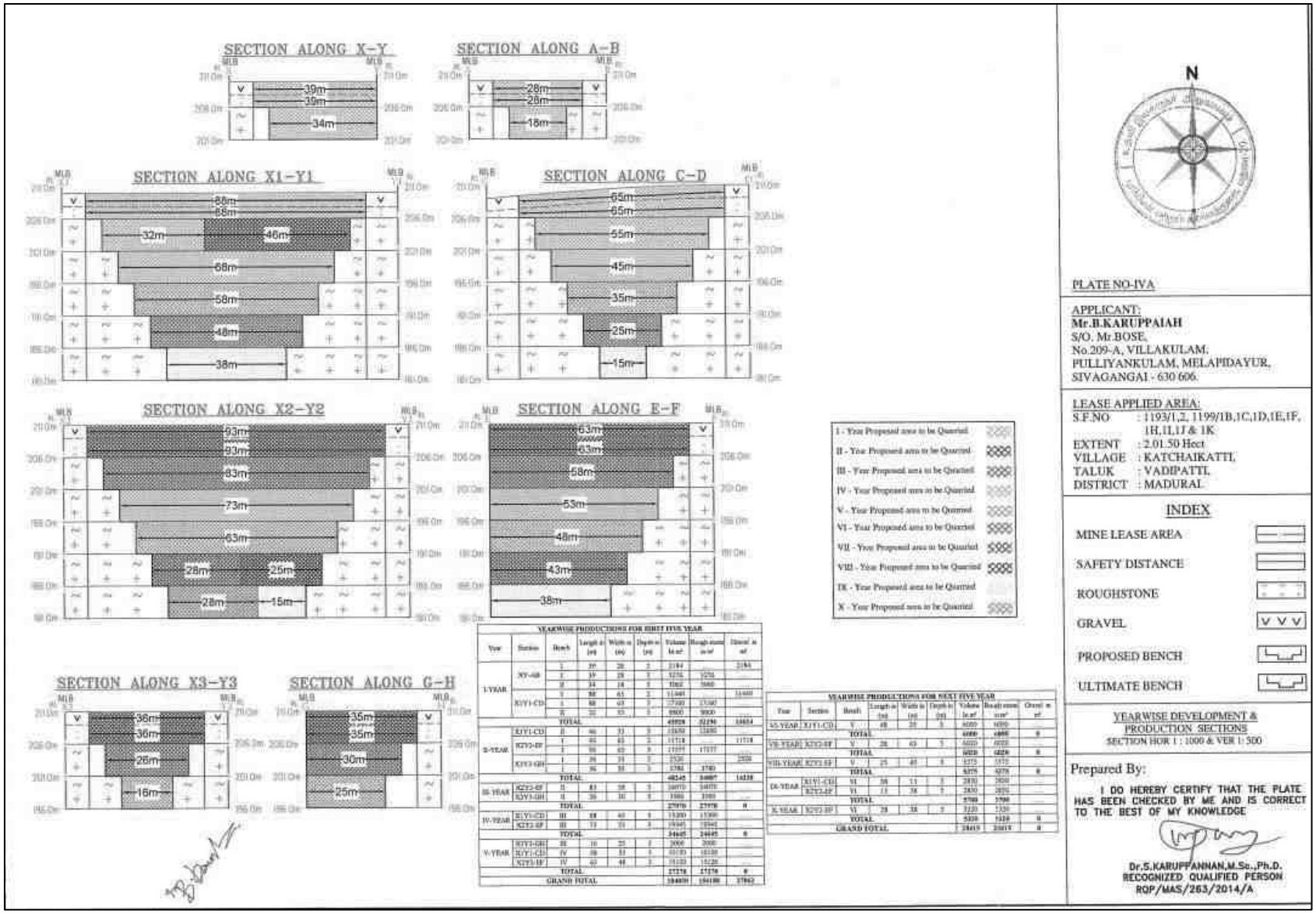


Figure 2.7a Year wise Development and Production Sections

2.6 MINING METHOD

The Quarrying operation is proposed to be carried out by open cast semi-mechanized mining method with the bench height and width of 5 m each. The open cast semi-mechanized method involving drilling and blasting is proposed to extract rough stone and gravel. The extracted rough stone will be loaded manually to the trucks for dispatch to the customers. In this project, NONEL blasting will be adopted to extract rough stone.

2.6.1 Conceptual Blasting Design

In this project, NONEL blasting will be employed to win rough stone. This method will involve closed spaced perimeter holes to reduce the overbreak/backbreak on a blast. The objective of the blasting design is to prevent fly rocks from damaging the nearby structures.

Rules of Thumb for Blast Design

Based on practical experience and technical information, a set of rules for blasting have been provided as below (Chapter8 (nps.gov)). These rules will be applied to blast rocks in the proposed project.

Rule 1: **The detonation velocity (VOD) of the explosive should be close to the same value of the sonic velocity (VSO) of the rock to be blasted.**

The sonic velocity of a rock is considered to be a reliable indicator of its structural integrity and resistance to fragmentation. As the VOD of the explosive approaches close to the VSO of the rock, the blasting would result in relatively smaller size of fragmentation with uniformity. There is no value in using an explosive that has a VOD greatly in excess of the VSO of the rock, since there is little or no improvement in fragmentation above the VSO. When selecting an explosive to match up the VSO of a rock mass, variance of <10% in the velocities is acceptable.

Rule 2: Generally, select the densest explosive possible.

When the density of explosives is higher, the potential energy of the explosives can be greater and the more of it can be placed within a borehole of a given size.

Rule 3: Select explosives according to the characteristics of the rock formation to be blasted.

When planes of separation in the rock are smaller than the degree of fragmentation required, the rock can often be blasted by using lower density and lower detonation velocity explosives.

Rule 4: When using slurry or water gel explosives, always determine the critical temperature below which the explosive will fail to reliably detonate.

Almost all slurry explosives have a critical temperature below which they may not detonate, or may not sustain detonation in elongated columns. The explosives should not be used when the temperature of the explosive at time of loading is below that critical temperature.

Rule 5: The distance between holes (spacing) should not be greater than one-half the depth of the borehole.

When the distance between holes in a row is greater than one-half the depth of the hole, the angles of breakage intersect above the bottom of the holes. This causes both a great deal of vertical throw and a very uneven bottom.

Rule 6: Stemming should be equal to the burden.

Stemming is useful to confine and maximize efficient use of the explosive's energy. It also reduces noise as much as possible. If the stemming is greater than the burden, the rock at the top of the borehole will have less cracking from reflection and refraction of compressive and tensile waves. Therefore, stemming should be equal to burden. Drill fines can be used for loading the borehole.

Rule 7: Subdrill (if necessary) should be between 0.3 and 0.5 of spacing/burden.

Subdrill should be equal to 0.3 of burden. It will work when there is row-for-row delay. In blasts where the delay system is both row-for-row and hole-for-hole, the subdrill should be determined by the largest dimension, which can be the spacing or the burden. An average subdrill of 0.4 of spacing is best to use for planning purposes. Based on the above-mentioned rules, blasting design has been conceptualized and has been provided in Table 2.5.

Table 2.5 Conceptual Blasting Design

Blasthole Diameter (D) in mm	32
Burden (B) in m	1.5
Spacing (S) in m	1.30
Subdrill in m	0.45
Charge length (C) in m	0.64
Stemming	1.5
Hole Length (L) in m	2.6
Bench Height (BH) in m	2.1
Mass of explosive/hole in g	400
Stemming material size in mm	3.2
Burden stiffness ratio	1.43

Blast volume/hole in m^3	4.16
Production of rough stone/day in m^3	116
Number of blastholes/day	28
Blasthole pattern	Staggered
Mass of explosive /day in kg	11.13
Powder factor in kg/m^3	0.10
Loading density	0.63
Type of explosives	Slurry
Diameter of packaging in mm	25
Initiation system	NONEL
Fly rock distance in m	19

2.6.2 Magnitude of Operation

Based on the results of estimated production for the 5 years, details about the size of operation have been provided in Table 2.6.

Table 2.6 Operational Details for Proposed Project

	Rough Stone in m^3 5 years	**Gravel in m^3 2 years**
Proposed production for 5 years	156188	27862
Number of Working Days /Annum	270	270
Production of /Day (m^3)	116	51
No. of Lorry Loads	19	8

2.6.3 Extent of Mechanization

List of machineries proposed for the quarrying operation is given in Table 2.7.

Table 2.7 Machinery Details

S. No.	**Type**	**No of Unit**	**Size /Capacity**	**Make**	**Motive Power**
1	Jack Hammers	3	Hand held	-	Diesel Drive
2	Compressor	1	Air	-	Diesel Drive
3	Hydraulic Excavator	1	2.9-4.5 m^3	-	Diesel Drive
4	Tipper	4	-	-	Diesel Drive

2.6.4 Progressive Quarry Closure Plan

The progressive quarry closure plan (Figure 2.8, 2.9 & 2.9a) of the proposed project shows past, present, and future land use statistics. According to the land use results, as shown in Table 2.8 At Present, about 2.01.5 ha of land is unutilized. Whereas, at the end of the mine life, about 1.46.92 ha of land will have been quarried; about 0.42.11 ha of land will be used for green belt development and 0.02.0 ha will be used for road and 0.03.0 ha will be used for infrastructures.

Table 2.8 Land use data at present, during scheme of mining, and at the end of mine life

Description	Present Area (ha)	Area at the end of life of quarry (ha)
Area under quarry	Nil	1.46.92
Infrastructure	Nil	0.03.0
Roads	Nil	0.02.0
Green Belt	Nil	0.42.11
Drainage & Settling Tank	Nil	0.07.47
Unutilized area	2.01.5	Nil
Total	**2.01.5**	**2.01.5**

2.6.5 Progressive Quarry Closure Budget

As the proposed project has the enormous potential for continuous operations even after the expiry of lease period, mine closure plan is not proposed for now. Based on the progressive mine closure plan for the scheme period, the mine closure cost is given in Table 2.9.

Table 2.9 Mine Closure Budget

Activity	Capital Cost	Recurring Cost/Annum
403 plants inside the lease area	80600	12090
605 plants outside the lease area	181350	18135
Wire Fencing (2.01.5 ha)	403000	20150
Renovation of Garland Drain (2.01.5 ha)	20150	10075
Total	**685100**	**60450**

Source: Environment Management Plan

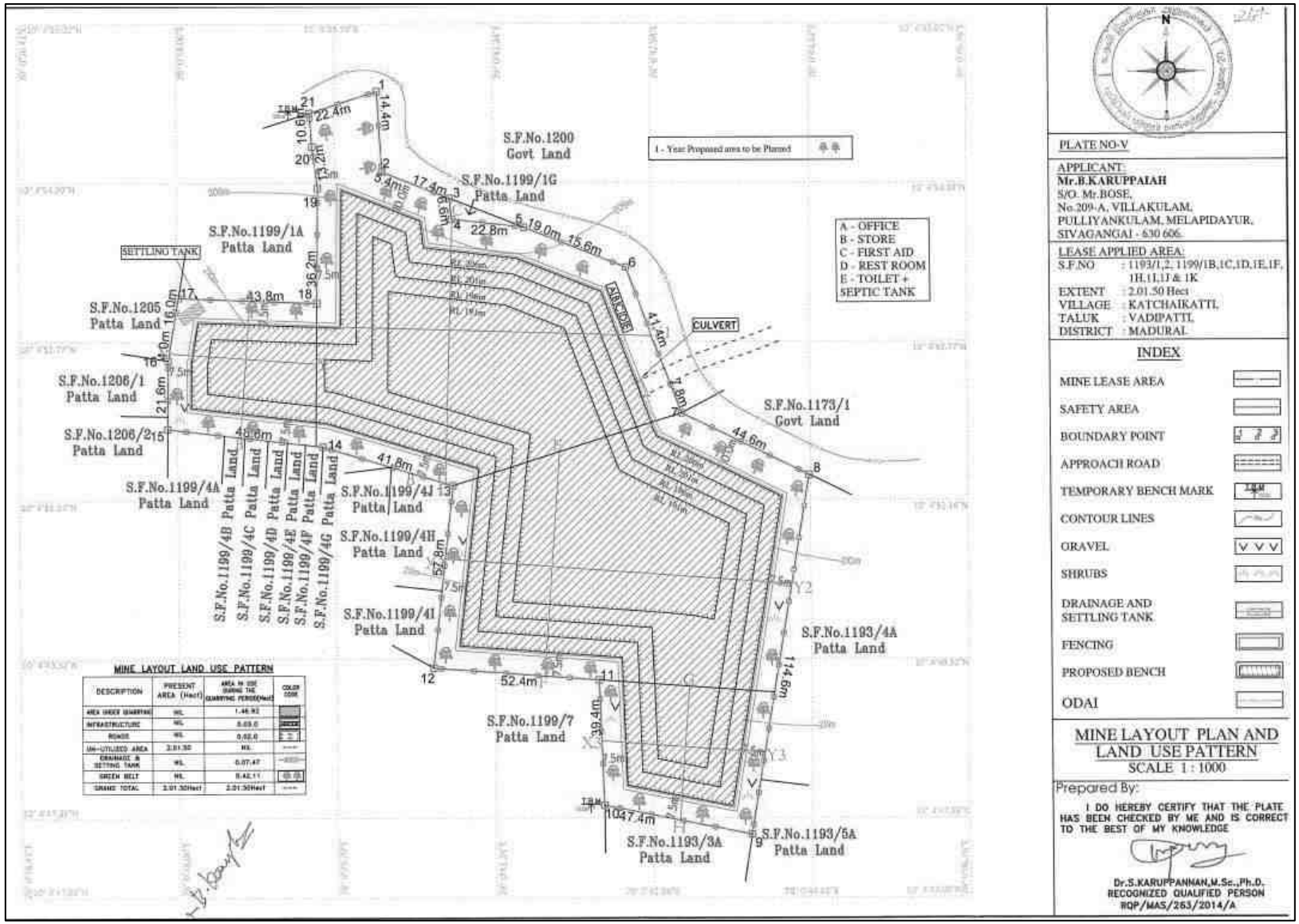


Figure 2.8 Mine Layout Plan and Land Use Pattern

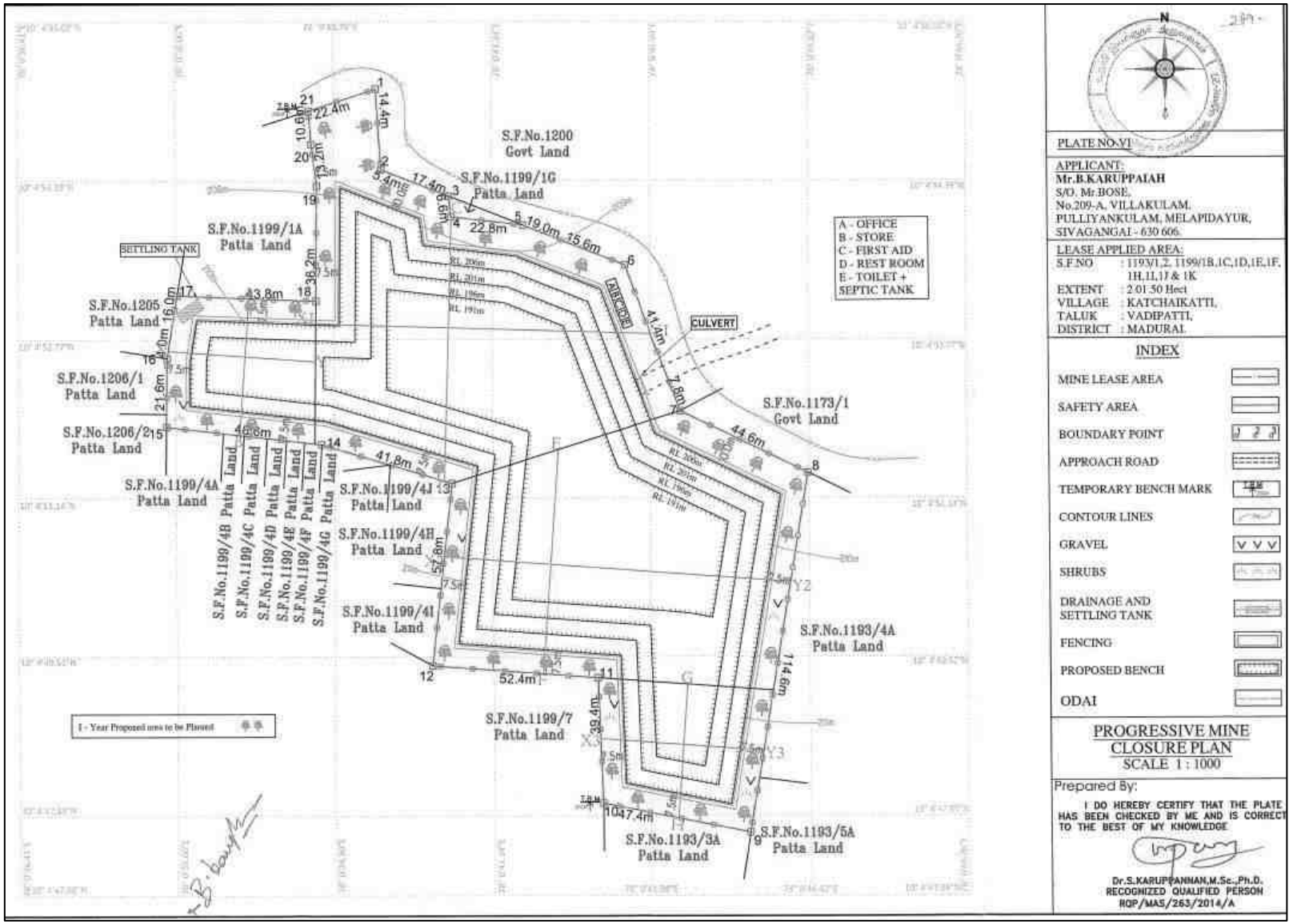
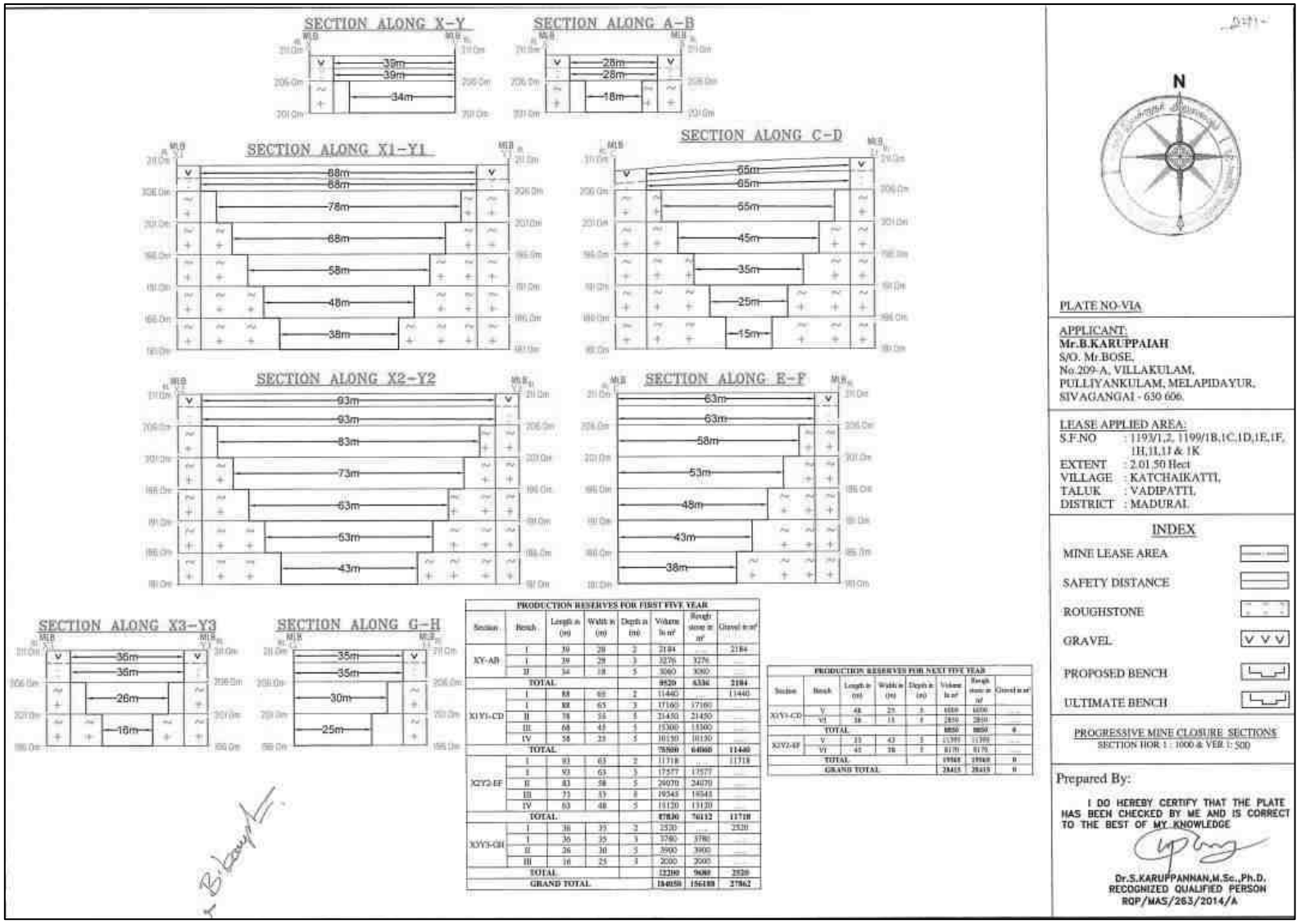


Figure 2.9 Progressive Mine Closure Plan



PRODUCTION RESERVES FOR FIRST FIVE YEAR

Section	Bench	Length in (m)	Width in (m)	Depth in (m)	Volume in m³	Rough stone in m³	Gravel in m³
XY-AB	I	39	28	2	2184	.....	2184
	I	39	28	3	3276	3276	.....
	II	54	18	5	3060	3060	.....
TOTAL					8520	6336	2184
X1Y1-CD	I	88	60	2	11440	.....	11440
	I	88	65	3	17160	17160	.....
	II	78	55	5	21450	21450	.....
	III	68	45	5	15300	15300	.....
	IV	58	35	5	10150	10150	.....
TOTAL					75500	64060	11440
X2Y2-EF	I	93	63	2	11718	.....	11718
	I	93	63	3	17577	17577	.....
	II	83	58	5	24070	24070	.....
	III	73	53	5	19345	19345	.....
	IV	63	48	5	15120	15120	.....
TOTAL					87830	76112	11718
X3Y3-GH	I	36	35	2	2520	.....	2520
	I	36	35	3	3780	3780	.....
	II	26	30	5	3900	3900	.....
	III	16	25	3	2000	2000	.....
TOTAL					12200	9680	2520
GRAND TOTAL					184050	156188	27862

PRODUCTION RESERVES FOR NEXT FIVE YEAR

Section	Bench	Length in (m)	Width in (m)	Depth in (m)	Volume in m³	Rough stone in m³	Gravel in m³
X1Y1-CD	V	48	25	3	6000	6000	.....
	VI	38	15	5	2850	2850	.....
TOTAL					8850	8850	0
X2Y2-EF	V	33	43	5	11395	11395	.....
	VI	43	38	5	8170	8170	.....
TOTAL					19565	19565	0
GRAND TOTAL					28415	28415	0

Figure 2.9a Progressive Mine Closure Plan and Sections

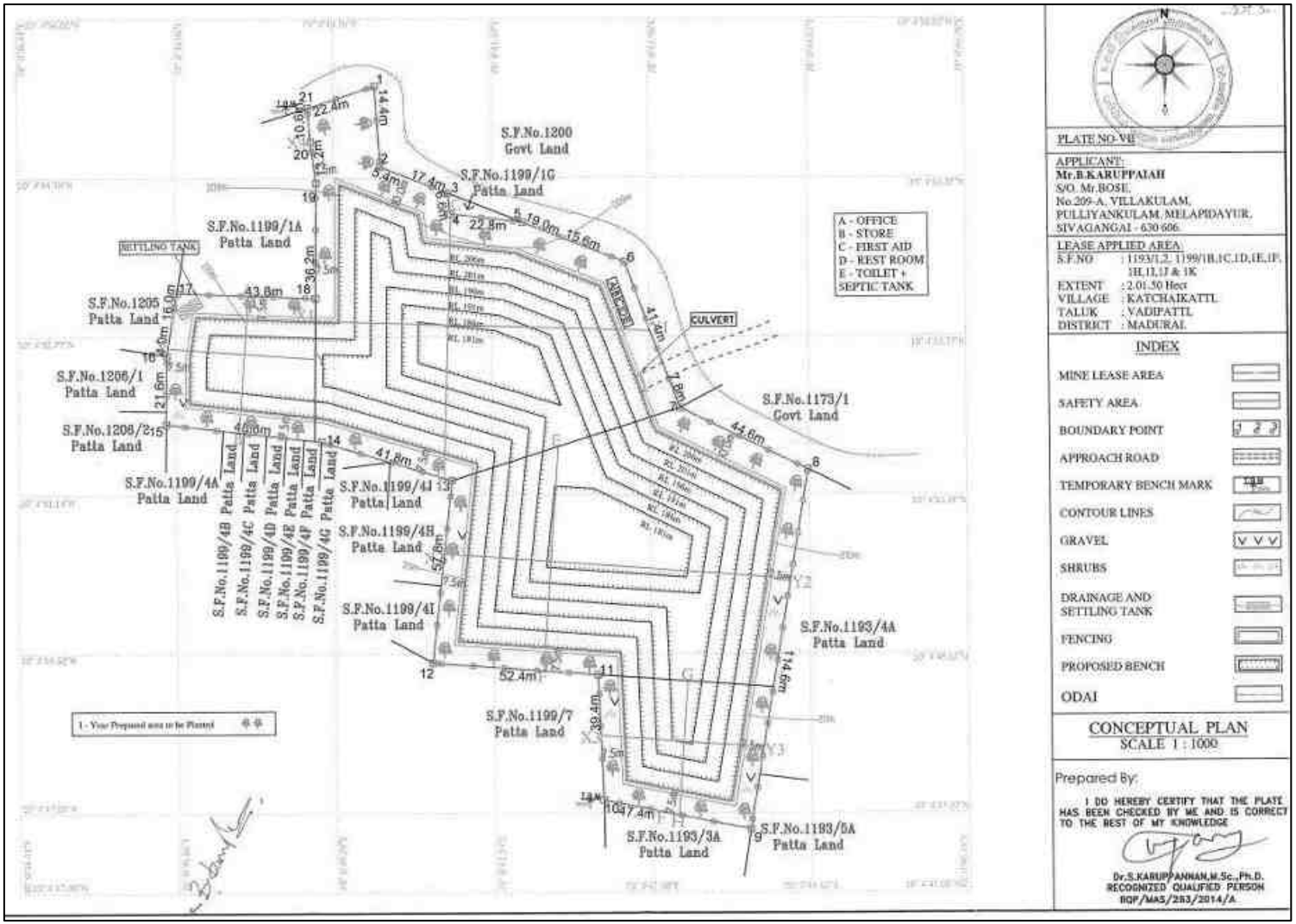


Figure 2.10 Conceptual Plan

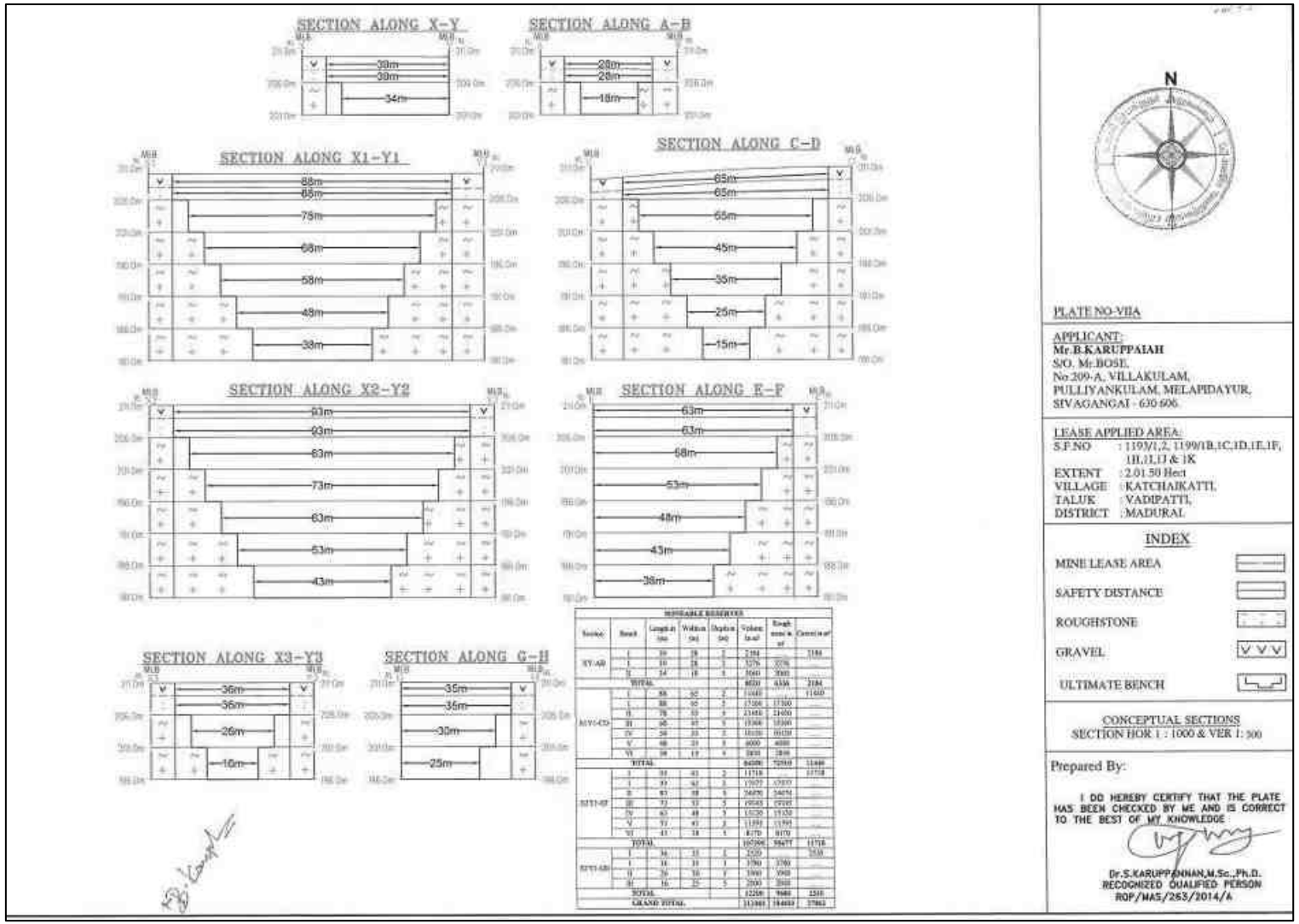


Figure 2.10a Conceptual Sections

2.6.6 Conceptual Mining Plan

The ultimate pit size is designed based on certain practical parameters such as economical depth of mining, safety zones, permissible area, etc. Details of ultimate pit dimensions have been derived from given in Table 2.10 and Figure 2.10, 2.10a.

Table 2.10 Ultimate Pit Dimension

Pit	Length (m)	Width (m) (Max)	Depth(m)
I	93	65	30

Source: Approved Mining Plan & ToR

2.6.7 Infrastructures

Infrastructures like mines office, temporary rest shelters for workers, latrine and urinal facilities have been proposed as per the mine rule and will be established after the grant of quarry lease. There is no proposal for the mineral processing or ore beneficiation plants in this project.

2.6.7.1 Other Infrastructure Requirement

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

2.6.8 Water Requirement

Detail of water requirement in KLD is given in Table 2.11.

Table 2.11 Water Requirement for the Project

Purpose	Quantity	Source
Dust Suppression	2.0 KLD	Existing bore wells nearby the lease area
Green Belt development	2.0 KLD	Existing bore wells nearby the lease area
Drinking & Domestic	1.9 KLD	Existing bore wells and approved water vendors
Total	**5.9 KLD**	

Source: Prefeasibility Report

2.6.9 Energy Requirement

High speed Diesel (HSD) will be used for quarrying machineries. As per the data shown in Table 2.12, around 7,58,214 litres of HSD will be used for rough stone and gravel extraction during this 5 years plan period. The diesel will be brought to the site from nearby diesel pumps.

Table 2.12 Fuel Requirement Details

Fuel Requirement for Excavator			
Details	**Rough Stone (156188 m^3)**	**Gravel (27862 m^3)**	**Total Diesel (litre)**
Average Rate of Fuel Consumption (l/hr)	16	10	---
Working Capacity (m^3/hr)	20	60	---
Time Required (hours)	7809	464	---
Total Diesel Consumption for 5 years (litre)	124950	4644	**129594**
Fuel Requirement for Compressor			
Average Rate of Fuel Consumption/hole (litre)	0.4	**---**	**---**
Number of Drillholes/day	28	**---**	**---**
Total Diesel Consumption for 5 years (litre)	15120	**---**	**15120**
Fuel Requirement for Tipper			
Average Rate of Fuel Consumption/Trip (litre)	20	20	---
Carrying Capacity in m^3	6	6	---
Number of Trips / days	19	3*	---
Number of Trips / 5 years	26031	4644	---
Total Diesel Consumption for 5 years (litre)	520627	92873	**613500**
Total Diesel Consumption by Excavator, Compressor and Tipper			**758214**

** Number of truck loads for gravel has been normalized for 5 years.*

2.6.10 Capital Requirement

The project proponent will invest **Rs.56,55,300/-** to the project. The breakup summary of the investment has been given in Table 2.13.

Table 2.13 Capital Requirement Details

S. No.	**Description**	**Cost (Rs.)**
1	Fixed Asset Cost	14,50,000/-
2	Machinery Cost	20,00,000/-
3	EMP Cost	22,05,300/-
Total Project Cost		**56,55,300/-**

Source: Approved Mining Plan

2.7 MANPOWER REQUIREMENT

The skilled, competent qualified statutory persons will be engaged for quarrying operation, preference will be given to the local community. Number of employees required for this project have been provided in Table 2.14.

Table 2.14 Employment Potential for the proposed project

S. No.	Category	Role	Nos.
1.	Highly Skilled	Quarry Manager	1
		Mines Forman	--
		Mechanical Engineer	--
		Account cum & admin	1
2.	Skilled	Driver	4
		Mechanic	--
		Earth Moving Operator	--
		Blaster / Mat	1
3	Semi - Skilled	Helpers, Greaser's	-
4	Unskilled	Musdoor / Labours	10
		Cleaners	1
		Attendant's	1
Total			**19**

Source: Prefeasibility Report

2.8 PROJECT IMPLEMENTATION SCHEDULE

The commercial operation will commence after the grant of Environmental Clearance. CTO and CTE 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. Expected time schedule for the quarrying operation is given Table 2.15.

Table 2.15 Expected Time Schedule

S. No.	Particulars	Time Schedule (in Months)					Remarks if any
		1st	2nd	3rd	4th	5th	
1	Environmental Clearance						
2	Consent to Establish						Project Establishment Period
3	Consent to operate						Production starting period.
Time line may vary; subjected to rules and regulations /& other unforeseen circumstances							

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

CHAPTER III

DESCRIPTION OF THE 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 to May, 2023** with CPCB guidelines. Environmental baseline data were collected by an NABL accredited and MoEF notified **Accuracy Analabs and Enviro Farmers Labs & Technologies** for the environmental attributes including soil, water, air, and noise and by FAEs for ecology and biodiversity, traffic, and socio-economy.

Study Area

The study area has been divided into two zones: core zone and buffer zone. Core zone is considered as lease area and buffer zone as 5 km radius from the periphery of the cluster, except for ecological study, which considers 10 km as buffer zone. Both core and buffer zones are taken as the study area. The data was collected from the study area to understand the existing environment conditions of the above-mentioned environmental components. Sampling methodologies for the various environmental parameters, including frequency of sampling, method of sample analysis, etc., are briefly given in 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 5 km radius of the study area	Once during the study period	Study Area	Satellite Imagery & Primary Survey
*Soil	Physico-Chemical characteristics	Once during the study period	8 (1 in core & 7 in 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	7 (2 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	PM_{10} $PM_{2.5}$ SO_2 NO_X Fugitive dust	24 hours, twice a week	7 (1 core & 6 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
*Noise Levels	Ambient noise	Hourly observation for 24 hours per location	7 (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.

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

3.1 LAND ENVIRONMENT

3.1.1 Geology and Geomorphology

Study area is mainly composed of acid to intermediate charnockite and Hornblende biotite genesis, as shown in Figure 3.1. The lease area occurs in charnockite terrain.

Among the geomorphic units, shallow weathered/buried pediplain and pediment dominate the study area, as shown in Figure 3.2. The lease area occurs in shallow weathered/buried pediplain terrain.

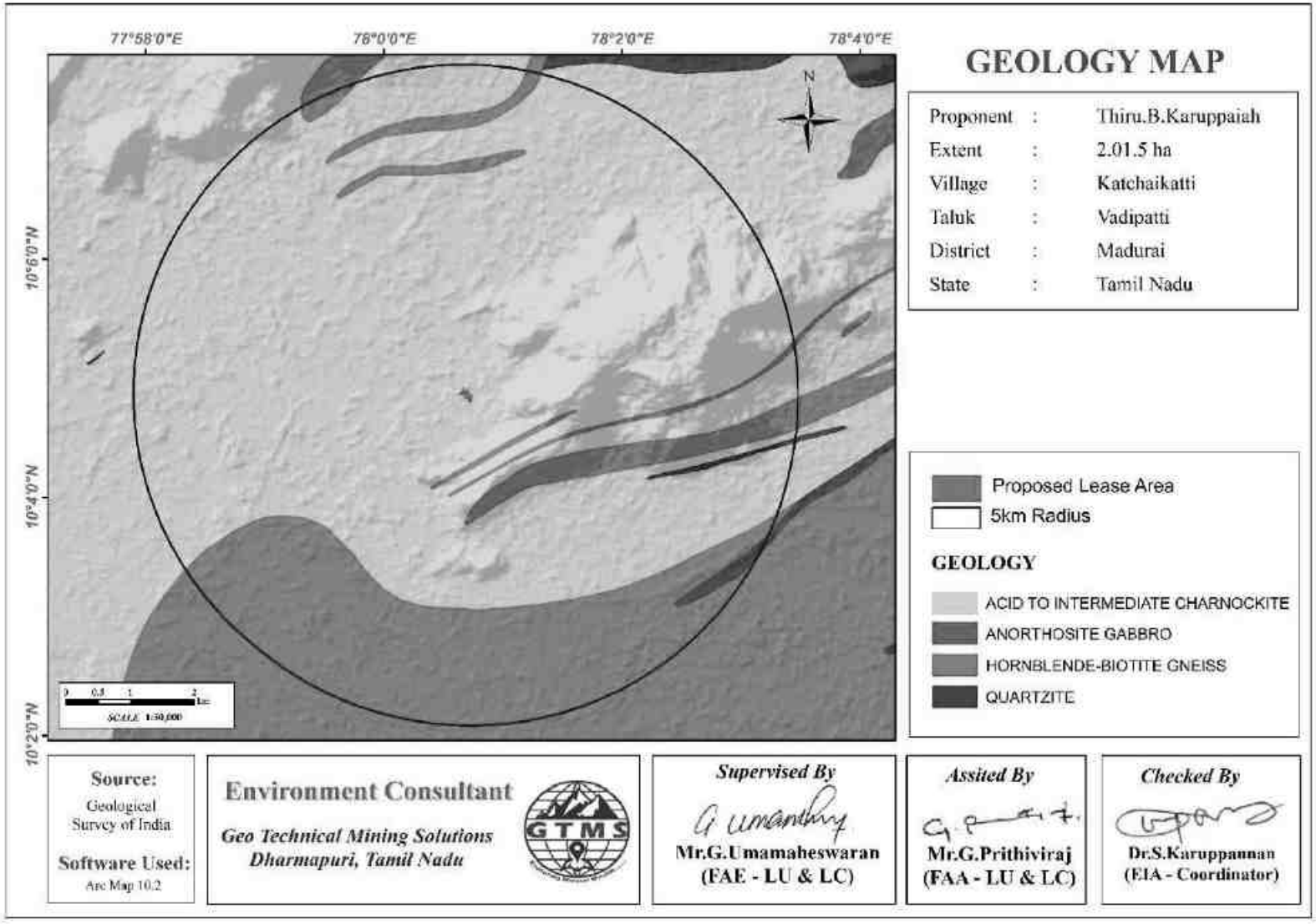


Figure 3.1 Geology Map of 5 km Radius from Proposed Project Site

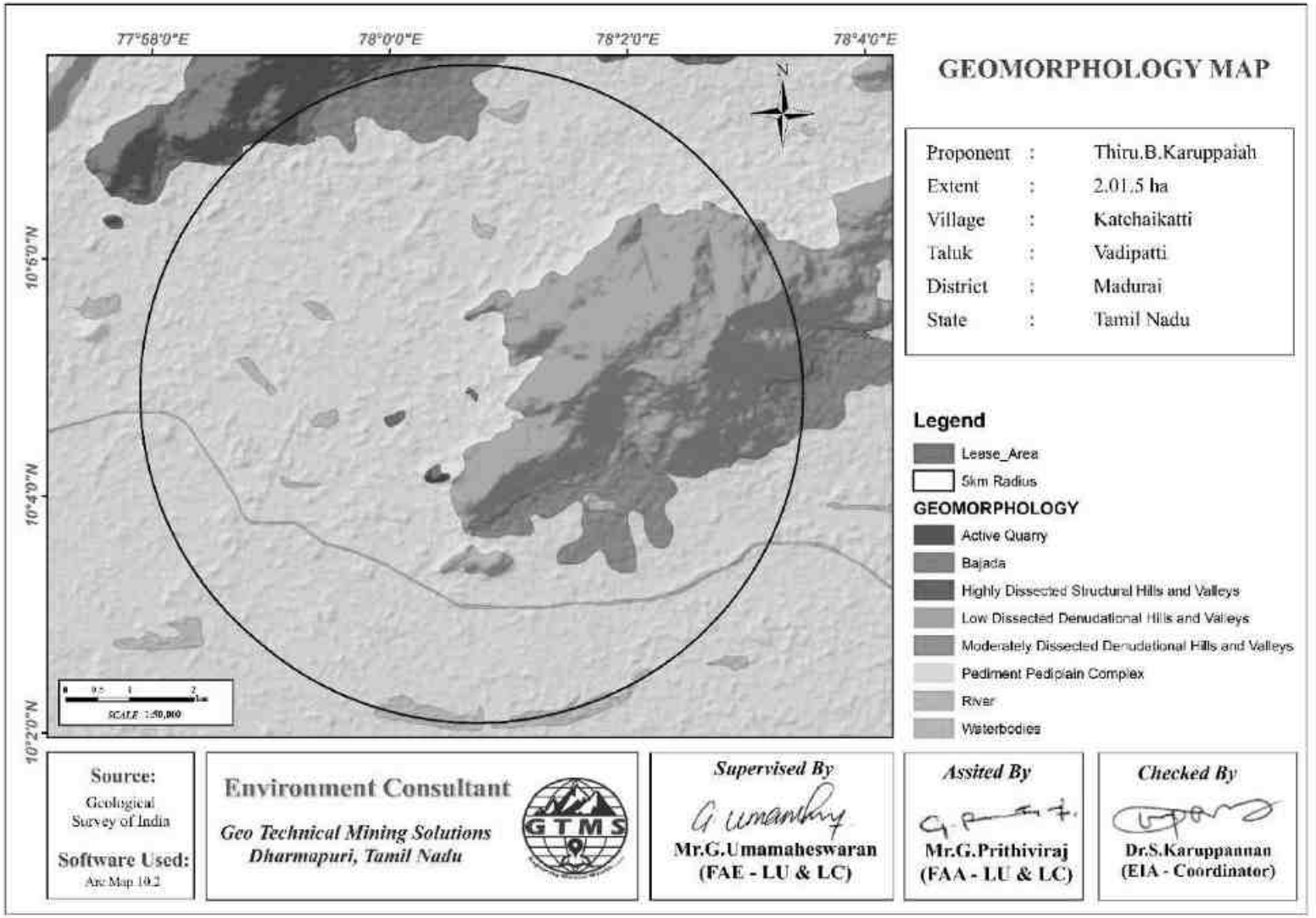


Figure 3.2 Geomorphology Map of 5 km Radius from Proposed Project Site

3.1.2 Land Use/ Land Cover

Land Use and Land Cover (LULC) map, as shown in Figure 3.3 was prepared using Sentinel II image for the study area of 5 km radius to provide a baseline status of the study area covering 5 km radius around the proposed mine site. Totally, 7 LULCs were mapped. The areal extent of each LULC is provided in Table 3.2. Of the total area, mining area covers only 70.80 ha accounting for 0.91 %, of which lease area of 2.01.5 ha contributes only about 0.026%. This small percentage of mining activities shall not have any significant impact on the land environment.

Table 3.2 LULC Statistics of the Study Area

S. No.	Classification	Area (ha)	Area (%)
1	Crop Land	5001.96	64.61
2	Dense Forest	506.19	6.54
3	Fallow Land	131.46	1.70
4	Land with or Without Scrub	557.97	7.21
5	Mining/Industrial lands	70.80	0.91
6	Plantations	1372.59	17.73
7	Settlements	100.88	1.30
Total		**7741.84**	**100.0**

Source: Sentinel II Satellite Imagery

3.1.3 Topography

The proposed lease area is located in a flat terrain with an altitude range of 209-211 m AMSL, showing relief of 2 m.

3.1.4 Drainage Pattern

Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin over time that reveals characteristics of the kind of rocks and geological structures in a landscape. The proposed area shows dendritic drainage pattern indicating uniform lithology beneath the surface, as shown in Figure 3.4.

3.1.5 Seismic Sensitivity

The proposed lease area is situated in a Seismic Zone II, as defined by National Center for Seismology (Official Website of National Centre of Seismology). The Zone II is defined as the region where only minor damage is expected from seismic events. In this respect, the proposed lease area is located in a low earthquake hazard area.

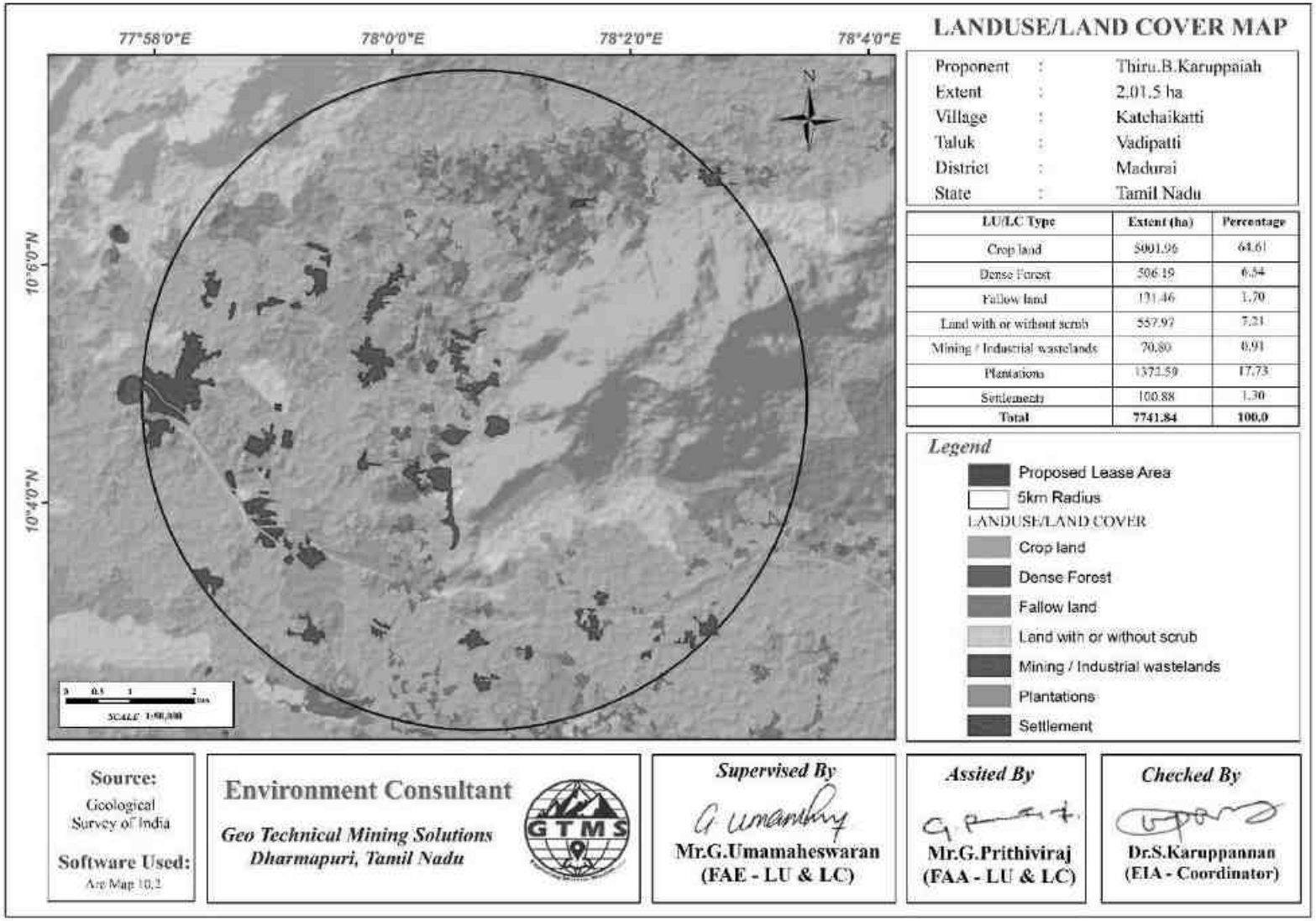


Figure 3.3 LULC Map of 5 km Radius from Proposed Project Site

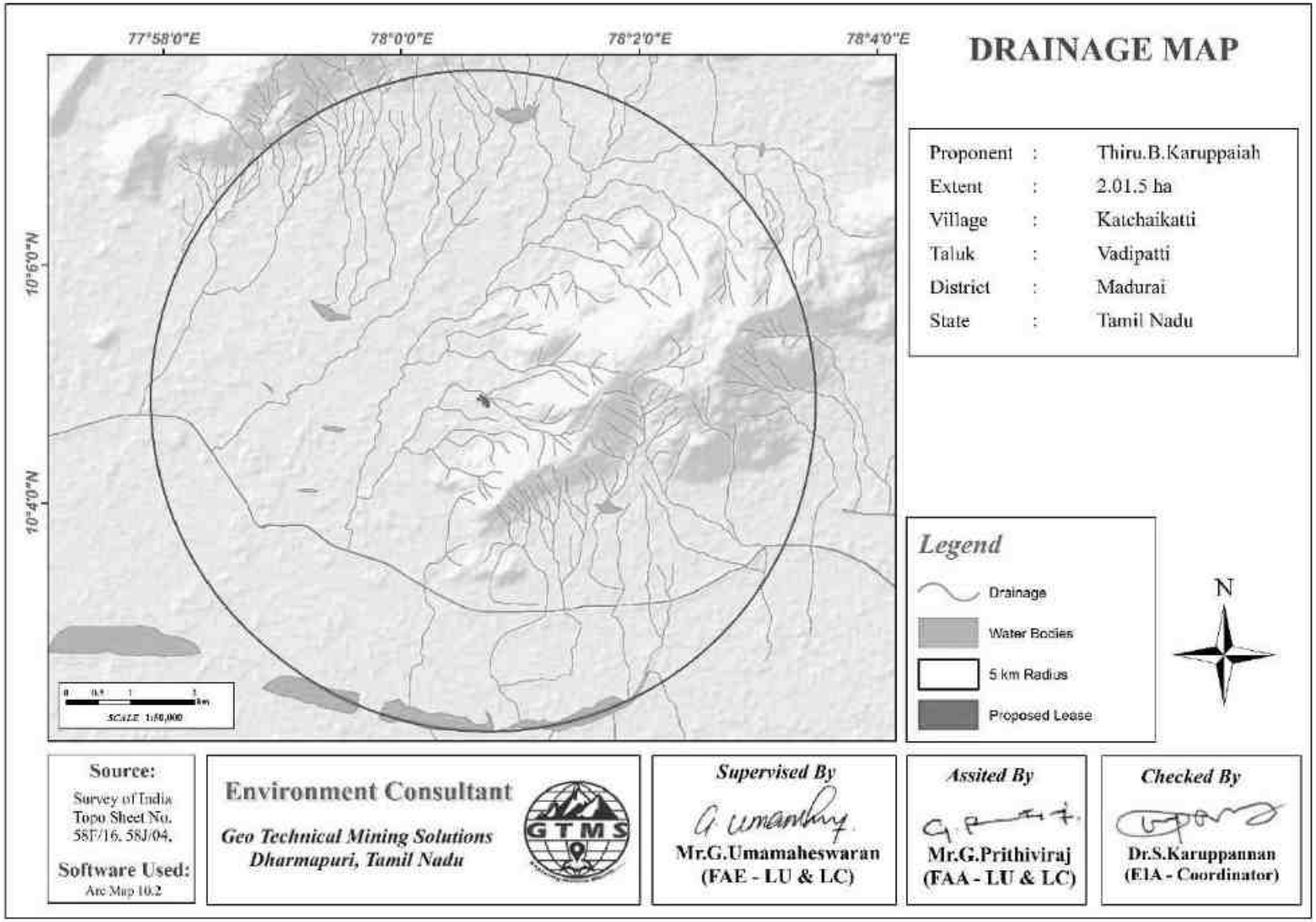


Figure 3.4 Drainage Map of 5 km Radius from Proposed Project Site

3.1.6 Soil

Composite soil samples were collected from 8 locations of the study area to determine the baseline soil characteristics of the soil. The locations were selected for soil sampling based on soil types, vegetative cover, and industrial & residential activities including infrastructure facilities. Soil samples were collected up to 90 cm depth, filled in polythene bags, coded and sent to laboratory for analysis. The locations of the sampling sites are shown in Table 3.3 and Figure 3.5. The samples thus collected were analysed for physical and chemical characteristics. The physical and chemical characteristic results of soil samples are provided in Table 3.4.

Table 3.3 Soil Sampling Locations

S. No.	Sample ID	Location	Distance (km)	Direction	Coordinates
1	S01	Core	---	---	10°04'48.66"N 78°0'43.34"E
2	S02	Ramayanpatti	0.82 km	NW	10°05'0.51"N 78°0'18.62"E
3	S03	Kutladamapatti River Sample	4.97 km	NNE	10°7'34.40"N 78°1'10.53"E
4	S04	T.Andipatti	3.17 km	SW	10°03'42.16"N77°59'23.77"E
5	S05	Sembukudipatti	3.67 km	S	10°02'47.62"N 78°0'48.92"E
6	S06	Periya Ilanthai Kulam	4.53 km	SE	10° 4'4.51"N 78° 3'6.21"E
7	S07	Thethoor	4.88 km	NE	10° 6'47.53"N 78° 2'34.18"E
8	S08	Semminipatti	3.07 km	SE	10° 5'50.36"N 77°59'20.35"E

Source: On-site monitoring/sampling by ***Accuracy Analabs and Enviro Farmers Labs & Technologies,*** *in association with GTMS.*

Physical Characteristics

The soil samples in the study area show loamy textures varying between silty clay loam, silty loam and sandy loam. pH of the soil varies from 6.41 to 7.27 indicating slightly acidic to slightly alkaline nature. Electrical conductivity of the soil varies from 3.45 to 4.33 µs/cm. Bulk density ranges between 0.61to 0.99g/cm^3.

Chemical Characteristics

Nitrogen ranges between 1.57 and 2.13 %. Phosphate ranges between 2.03 and 3.64 %. Potassium ranges between 3.48 and 5.25 %. Calcium ranges between 1579 and 2516 mg/kg. Total carbon ranges between 23.7 and 31.5 %.

Soil Erosion

There is no soil erosion in the mining lease area. The south east and south west part of the lease area has less moderate soil erosion as shown in the soil erosion map in Figure 3.6

Soil Quality Assessment

Soil quality is the foundation of sustainable crop production. Soil quality assessment helps to understand soil conditions and adopt suitable production practices. It can be done using physical, chemical, and biological properties of soil. For this assessment, four soil quality parameters including pH, EC, OM, and BD were taken into account. The soil quality score for each sample has been provided in Table 3.4a.

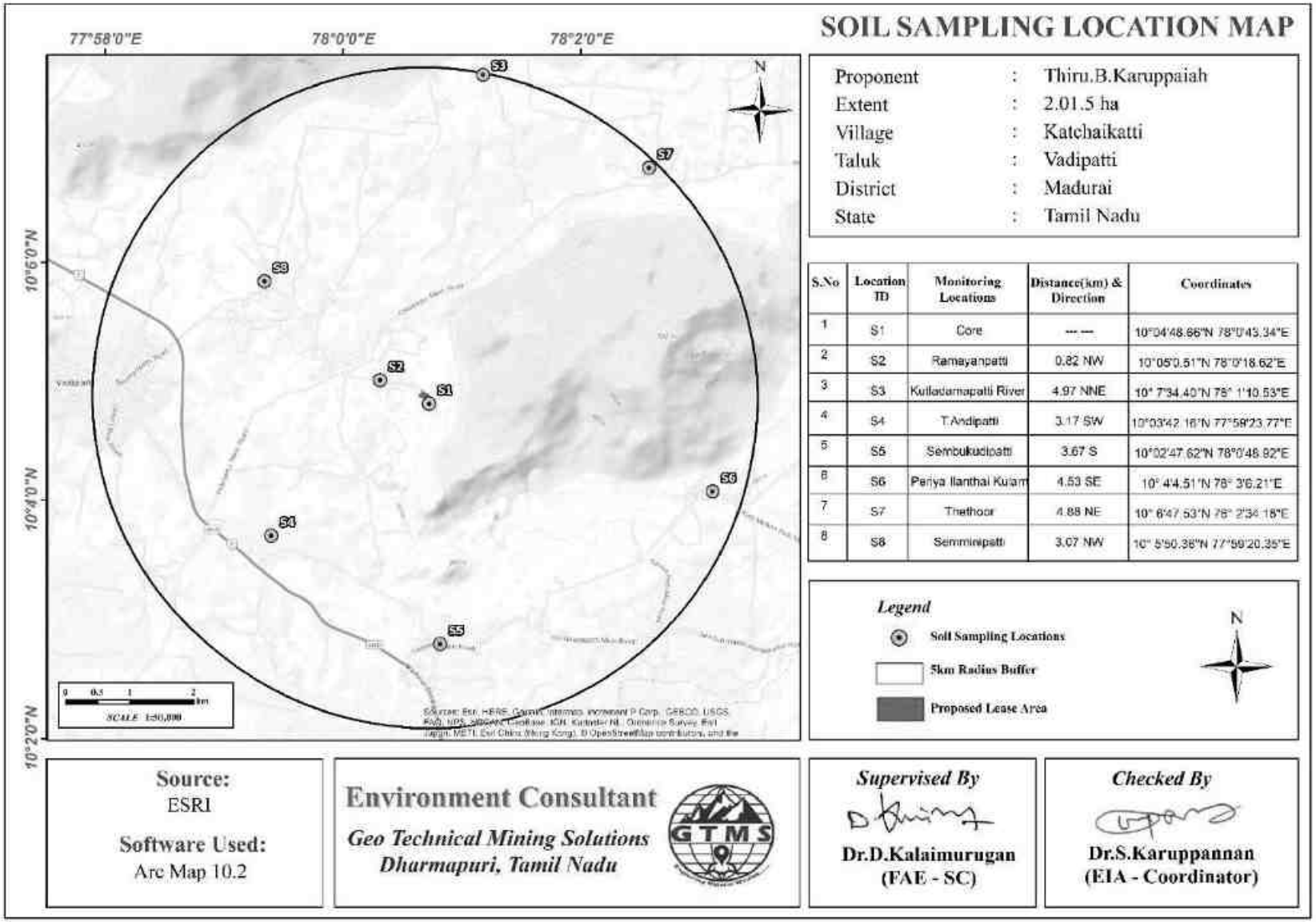


Figure 3.5 Toposheet Showing Soil Sampling Locations within 5 km Radius around Proposed Project Sit

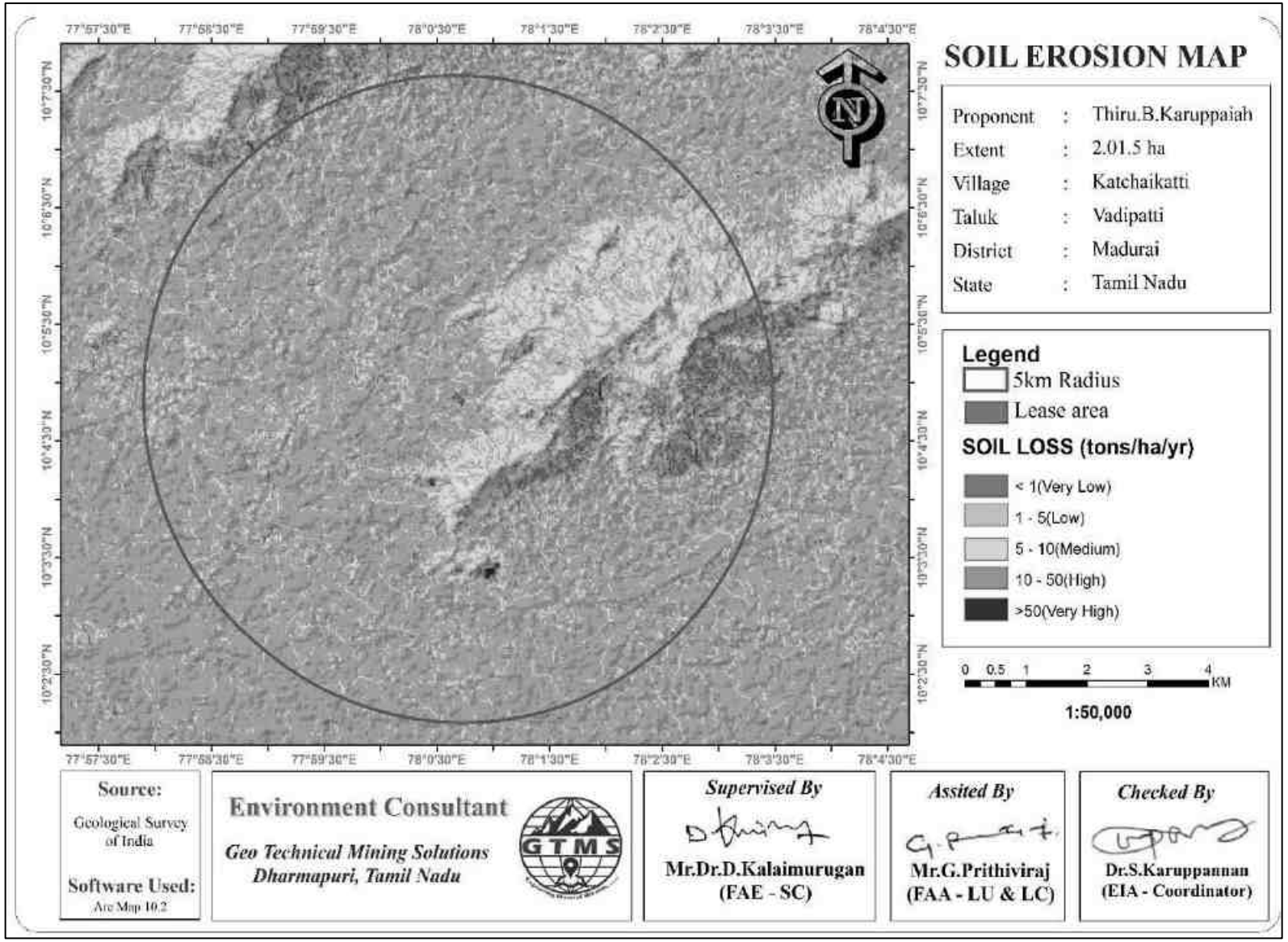


Figure 3.6 Soil Erosion Map within 5 km Radius around Proposed Project Site

Table 3.4 Soil Quality of the Study Area

S. No.	Parameters	Unit	S01 (Core)	Minimum	Maximum	Average
1	Colour	-	Brown Colour	Sand Colour, Brown Colour, Light Brown Colour, Dark Brown		
2	Odour	-	No foul odour	No foul odour		
3	Moisture @15°C	%	25.7	15.1	34.3	23.48
4	Bulk Density	g/cm^3	0.94	0.61	0.99	0.85
5	Particles					
	Sand	%	29.5	32.15	40.32	36.47
	Silt	%	25.25	27.51	38.45	32.64
	Clay	%	45.25	26.07	38.53	30.88
6	pH @ 25°C in 5% Solution	-	7.33	6.41	7.47	7.03
7	EC @ 25°C	µS/cm	3.47	3.45	4.33	3.91
8	Nitrogen (N)	%	1.61	1.57	2.13	1.84
9	Phosphate (P)	%	3.41	2.03	3.64	3
10	Potassium (K)	%	5.23	3.48	5.25	4.33
11	Total Carbon	%	26.7	23.7	31.5	27.72
12	C: N Ratio	-	15.9:1	11.5:1	15.3:1	13.4:1
13	Arsenic (As)	mg/kg	BDL [DL 0.1]	BDL [DL 0.1]	BDL [DL 0.1]	BDL [DL 0.1]
14	Mercury (Hg)	mg/kg	BDL [DL 0.001]	BDL [DL 0.001]	BDL [DL 0.001]	BDL [DL 0.001]
15	Lead (Pb)	mg/kg	18.7	18.1	20.3	19.08
16	Cadmium (Cd)	mg/kg	0.52	0.43	0.69	0.55
17	Chromium (Cr)	mg/kg	9.29	7.22	9.39	8.42
18	Copper (Cu)	mg/kg	23.7	22.5	26.3	23.98

19	Zinc (Zn)	mg/kg	33.6	25.7	32.5	29.34
20	Nickel (Ni)	mg/kg	BDL [DL 0.1]	BDL [DL 0.1]	BDL [DL 0.1]	BDL [DL 0.1]
21	Calcium (Ca)	mg/kg	1334.0	1579	2516	2049.37
22	Magnesium (Mg)	mg/kg	1026.0	1221.3	1714.3	1477.48
23	Porosity	%	20.7	0.75	1.12	0.94
24	Water Retention	Inch of water / foot of soil	1.57	0.71	1.41	1.21
25	Salinity	PPT	8.42	9.47	19.5	14.49
26	SAR value	-	2.32	2.81	6.17	4.60

Source: Sampling Results by ***Accuracy Analabs and Enviro Farmers Labs & Technologies,*** *in association with GTMS*

Table 3.4a Assigning Scores to Soil Quality Indicators

Soil Quality Score						
S. No.	OM	BD	pH	EC	**Total Score**	**Recommendation**
S01	56	13	13	2	84	The soil requires moderate treatment
S02	56	13	20	2	91	Soil is healthy. But the soil requires maintenance to avoid degradation
S03	56	13	20	2	91	
S04	56	13	13	2	84	The soil requires moderate treatment
S05	56	13	20	2	91	Soil is healthy. But the soil requires maintenance to avoid degradation
S06	56	13	20	2	91	
S07	56	13	20	2	91	
S08	33	2	20	11	91	

(BD) Bulk Density (OM) Organic Matter (EC) Electrical Conductivity.

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 baseline quality of surface and ground water.

Table 3.5 Water Sampling Locations

S. No	Sampling ID	Location	Distance (km)	Direction	Coordinates
1	OW1	Near Core	0.05	W	10° 4'53.98"N, 78° 0'36.54"E
2	BW1	Ramayanpatti	0.84	WNW	10° 5'0.32"N, 78° 0'11.53"E
3	BW2	Thanichiyam	3.72	SSW	10° 3'0.35"N, 77°59'47.45"E
4	BW3	Periya Ilanthaikulam	4.34	SE	10° 4'6.51"N, 78° 3'0.37"E
5	BW4	Vadipatti	3.39	NE	10° 4'57.61"N, 77° 58'22.13"E
6	SW1	Near Core	0.01	N	10° 4'54.26"N, 78°0'41.80"E
7	SW2	Kuttalampatti water falls	4.89	NNE	10° 7'32.49"N, 78°1'4.18"E

Source: On-site monitoring/sampling by **Accuracy Analabs***, in association with GTMS.*

3.2.1 Surface Water Resources and Quality

Kuttalampatti waterfalls and Canal near in mine lease area are the two prominent surface water resources present in the study area. These are ephemeral in nature, which convey water only after rainfall events. The proposed project area is located 0.01 km N of Canal Near and 4.89 km NNW of Kuttalampatti waterfalls, as shown in Table 3.5 and Figure 3.5. Two surface water samples, known as SW1 and SW2 were collected from the two surface water bodies to assess the baseline water quality. Table 3.7 summarizes surface water quality data of the two samples.

Result for surface water sample in the Table 3.7 indicate that the physical, chemical and biological parameters, and heavy metals are within permissible limits in comparison with standards of IS10500:2012.

3.2.2 Ground Water Resources and Quality

Groundwater in the study area occurs in the crystalline rocks of Archaean age and recent alluvium. The movement of the groundwater is controlled by the intensity of weathering and fracturing of crystalline rocks. Dug wells and bore wells are the most common ground water

abstraction structures in the area. However, in dry season, people in the study area heavily rely on bore wells for their domestic and agriculture purpose.

Five groundwater samples, known as BW01, BW02, BW03, BW04 and OW01 collected from bore wells and open wells were analysed for physico-chemical conditions, heavy metals and bacteriological contents in order to assess baseline quality of ground water. Ground water sampling locations and their distance and direction from the lease area are provided in Table 3.5 and the spatial occurrence of water sampling locations is shown in Figure 3.7. Table 3.6 summarizes ground water quality data of the five samples.

Results for ground water samples in the Table 3.6 indicate that the physical, chemical and biological parameters, and heavy metals are within permissible limits in comparison with standards of IS10500:2012.

3.2.3 Hydrogeological Studies

The area within 2 km radius consists of numerous open wells and deep wells. Groundwater level data were collected both from open wells and bore wells for two monsoon seasons as discussed in the following section.

3.2.3.1 Groundwater Levels and Flow Direction

Data regarding depth to groundwater levels are essential to infer the direction of groundwater movement within the study area. Knowledge of groundwater flow direction is must in choosing location for background groundwater quality monitoring well and in locating recharge and discharge areas. Therefore, data regarding groundwater elevations were collected from 9 open wells and 9 bore wells at various locations within 2 km radius around the proposed project sites for the period from March through May 2023 (Pre-Monsoon Season) and from October through December, 2022 (Post Monsoon Season).

The open well water level data thus collected onsite are provided in Tables 3.8 and 3.9. According to the data, average depths to the static water table in open wells range from 15.2 to 18.5 m BGL in pre monsoon and 12.2 to 15.8 m BGL in post monsoon. The bore well data thus collected onsite are provided in Tables 3.10 and 3.11. The average depths to static potentiometric surface in bore wells for the period of October through December 2022 (Post-Monsoon Season) vary from 63.8 to 66.3 m and from 62.3 to 65.8 m for the period of March through May, 2023 (Pre-Monsoon Season). Data on the depths to static water table and potentiometric surface were used to draw contour lines connecting groundwater elevation (also known as equipotential hydraulic head) to determine the groundwater flow direction perpendicular to the contour lines.

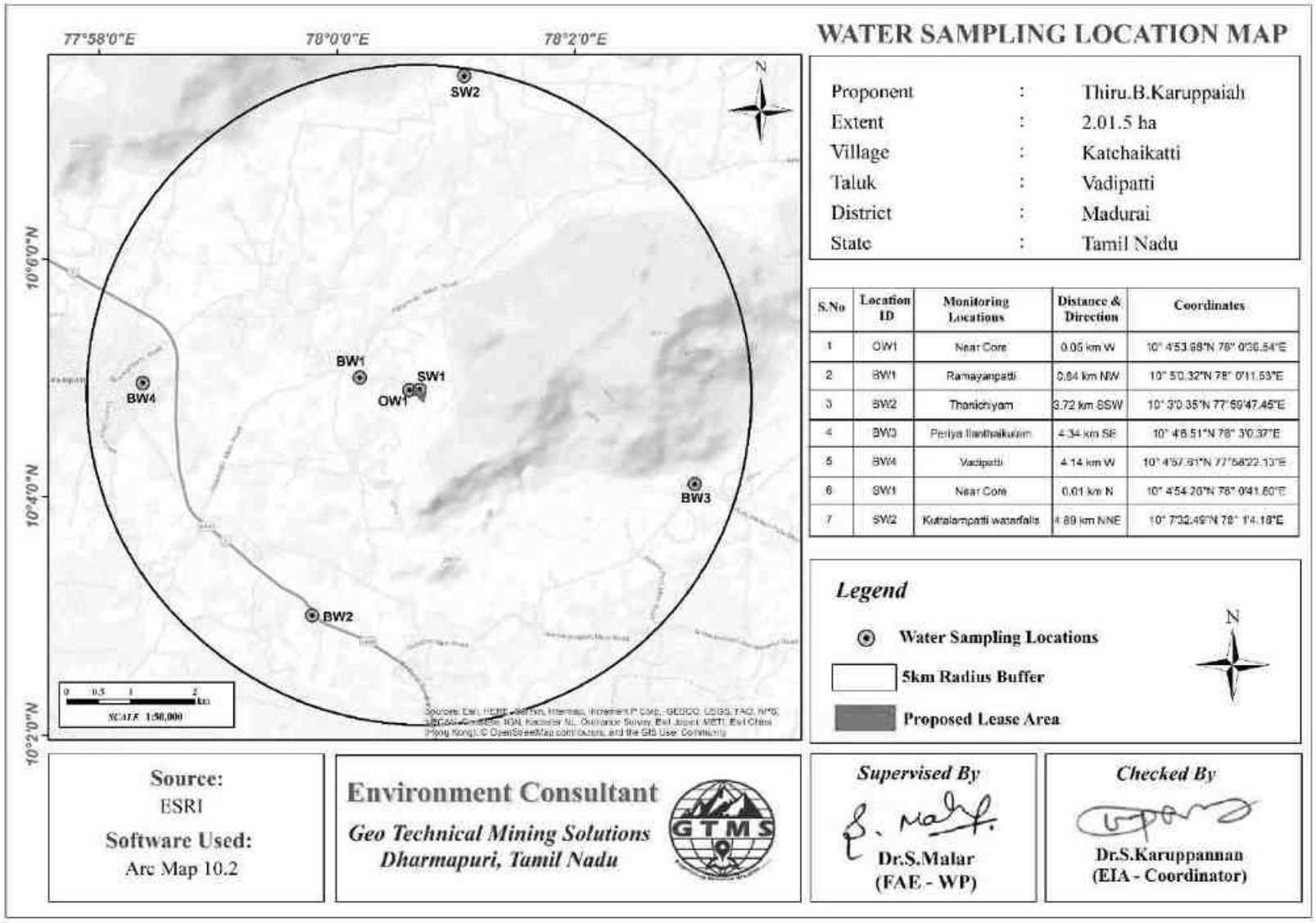


Figure 3.7 Toposheet Showing Water Sampling Locations within 5 km Radius around Proposed Project Site

Table 3.6 Ground Water Quality Result

S.No.	Parameters	Units	Minimum	Maximum	Average	Acceptable Limits As per IS 10500:2012	Permissible Limits As Per IS 10500:2012
1	Colour	Hazen	<0	1	1	5	15
2	Odour	Odourless	Odourless	Odourless	Odourless	Agreeable	Agreeable
3	pH@ 25°C	-	6.72	7.51	7.06	6.5 – 8.5	No relaxation
4	TDS @ 180^0 C	mg/l	240	1490	514.4	500	2000
5	Total Hardness (as $CaCO_3$)	mg/l	174	496	211.6	200	600
6	Calcium Hardness	mg/l	7	351	172.4	-	-
7	Magnesium Hardness	mg/l	6	201	102.2	-	-
8	Calcium (as Ca)	mg/l	3.6	141	79.52	75	200
9	Magnesium (as Mg)	mg/l	1.4	61	33.68	30	100
10	Chloride (as Cl)	mg/l	16	545	264.6	250	1000
11	Total Alkalinity (as $CaCO_3$)	mg/l	12	205	125	200	600
12	Sulphate (as SO_4)	mg/l	11	295	111	200	400
13	Turbidity	NTU	<1.0	<1.0	<1.0	1.0	5
BIOLOGICAL REPORT							
14	E. coli	MPN/100ml	6	22	15.6	-	1600
15	Coliform	MPN/100ml	13	26	18.4	-	1600

*Source: Sampling Results by **Accuracy Analabs,** in association with GTMS.*

Table 3.7 Surface Water Quality Result

S.No.	Parameters	Units	Result of Surface Water			Acceptable Limits As per IS10500:2012	Permissible Limits As Per IS 10500:2012
			Minimum	Maximum	Average		
1	Colour	Hazen	<0	<0	<0	5	15
2	Odour	Odourless	Odourless	Odourless	Odourless	Agreeable	Agreeable
3	pH@ 25°C	-	6.87	7.21	6.92	6.5 – 8.5	No relaxation
4	TDS @ 180^0 C	mg/l	99	100	99.5	500	2000
5	Total Hardness (as $CaCO_3$)	mg/l	23	25	24	200	600
6	Calcium Hardness	mg/l	9	12	10.5	-	-
7	Magnesium Hardness	mg/l	13	14	13.5	-	-
8	Calcium (as Ca)	mg/l	3.6	3.6	3.6	75	200
9	Magnesium(as Mg)	mg/l	3.1	3.4	3.25	30	100
10	Chloride (as Cl)	mg/l	48	50	49	250	1000
11	Total Alkalinity (as $CaCO_3$)	mg/l	15	16	15.5	200	600
12	Sulphate (as SO_4)	mg/l	30	30	30	200	400
13	Turbidity	NTU	<1.0	<1.0	<1.0	1.0	5
BIOLOGICAL REPORT							
14	E. coli	MPN/100ml	10	13	11.5	-	1600
15	Coliform	MPN/100ml	13	17	15	-	1600

*Source: Sampling Results by **Accuracy Analabs,** in association with GTMS*

From the maps of open well groundwater flow direction shown in Figures 3.8-3.9, it is understood that most of the open well groundwater for the post- and pre-monsoon seasons flows towards the open well number 5 located in northwestern direction of the proposed project site. The groundwater flow maps in Figures 3.10-3.11 show that most of the bore well groundwater for the post- and pre-monsoon seasons flow towards the bore well number 5 and 7. It is located in northwestern and northern direction of the proposed project site. On the basis of the groundwater flow information, both open wells and bore wells mentioned above can be chosen for water quality monitoring purpose as the wells may get easily affected by the contaminants resulting from the mining activities of the sites in future.

Table 3.8 Pre-Monsoon Water Level of Open Wells within 2 km Radius

Station ID	Depth to Static Water Table BGL (m)				Latitude	Longitude
	Mar-2023	Apr-2023	May- 2023	Average		
DW01	18.4	17.3	15.8	17.17	10° 5'1.12"N	78°0'23.24"E
DW02	18.1	16.9	15.4	16.80	10°4'50.73"N	78°0'20.88"E
DW03	17.9	16.7	15.2	16.60	10°4'43.50"N	78°0'23.59"E
DW04	18.3	17.5	16.1	17.30	10°4'42.67"N	78°0'42.46"E
DW05	18.5	17.2	16.1	17.27	10° 5'2.73"N	78°0'36.55"E
DW06	18.2	17.4	16.4	17.33	10°5'38.38"N	78°0'23.76"E
DW07	18.4	17.6	16.5	17.50	10°4'23.22"N	78°0'33.44"E
DW08	17.8	16.5	15.4	16.57	10°4'32.79"N	78°0'1.39"E
DW09	18.2	17.1	16.2	17.17	10°5'16.09"N	78°0'3.31"E

Source: Onsite monitoring data

Table 3.9 Post-Monsoon Water Level of Open Wells within 2 km Radius

Station ID	Depth to Static Water Table BGL(m)				Latitude	Longitude
	Oct-2022	Nov- 2022	Dec-2022	Average		
DW01	15.4	13.6	12.1	17.17	10° 5'1.12"N	78° 0'23.24"E
DW02	14.8	12.7	11.9	16.80	10° 4'50.73"N	78° 0'20.88"E
DW03	14.5	13.1	12.2	16.60	10° 4'43.50"N	78° 0'23.59"E
DW04	15.8	14.5	13.1	17.30	10° 4'42.67"N	78° 0'42.46"E
DW05	15.2	13.5	12.1	17.27	10° 5'2.73"N	78° 0'36.55"E
DW06	15.5	14.1	13.4	17.33	10° 5'38.38"N	78° 0'23.76"E
DW07	15.6	13.9	12.8	17.50	10° 4'23.22"N	78° 0'33.44"E
DW08	14.7	13.2	12.6	16.57	10° 4'32.79"N	78° 0'1.39"E
DW09	14.9	13.4	12.2	17.17	10° 5'16.09"N	78° 0'3.31"E

Source: Onsite monitoring data

Table 3.10 Pre-Monsoon Water Level of Bore Wells within 2 km Radius

Station ID	Depth to Static Potentiometric Surface BGL(m)				Latitude	Longitude
	Mar-2023	Apr-2023	May- 2023	Average		
BW01	68.3	69.4	70.2	69.30	10° 4'16.38"N	78° 0'8.26"E
BW02	65.4	67.2	69.7	67.43	10° 4'20.84"N	77°59'44.76"E
BW03	69.5	70.6	72.1	70.73	10° 5'0.43"N	78° 0'11.51"E
BW04	68.4	70.4	71.8	70.20	10° 5'5.58"N	77°59'49.44"E
BW05	69.3	70.2	71.8	70.43	10° 5'14.70"N	77°59'52.13"E
BW06	70.2	70.9	72.5	71.20	10° 5'50.02"N	77°59'58.65"E
BW07	70.5	71.6	72.7	71.60	10° 5'45.01"N	78° 0'40.77"E
BW08	69.5	70.6	71.8	70.63	10° 5'24.57"N	78° 0'22.07"E
BW09	71.6	72.4	72.9	72.30	10° 4'42.67"N	78° 0'51.32"E

Source: Onsite monitoring data

Table 3.11 Post-Monsoon Water Level of Bore Wells within 2 km Radius

Station ID	Depth to Static Potentiometric Surface BGL(m)				Latitude	Longitude
	Oct-2022	Nov-2022	Dec-2022	Average		
BW01	64.50	63.2	61.4	65.3	10° 4'16.38"N	78° 0'8.26"E
BW02	64.10	63.4	60.8	64.3	10° 4'20.84"N	77°59'44.76"E
BW03	65.10	63.7	61.8	66.3	10° 5'0.43"N	78° 0'11.51"E
BW04	64.70	63.4	61.4	67.6	10° 5'5.58"N	77°59'49.44"E
BW05	65.30	64.1	61.7	67.3	10° 5'14.70"N	77°59'52.13"E
BW06	65.80	64.4	62.2	65.3	10° 5'50.02"N	77°59'58.65"E
BW07	66.20	65.1	63.4	63.8	10° 5'45.01"N	78° 0'40.77"E
BW08	65.10	64.2	61.8	66.3	10° 5'24.57"N	78° 0'22.07"E
BW09	66.50	65.1	63.2	65.3	10° 4'42.67"N	78° 0'51.32"E

Source: Onsite monitoring data

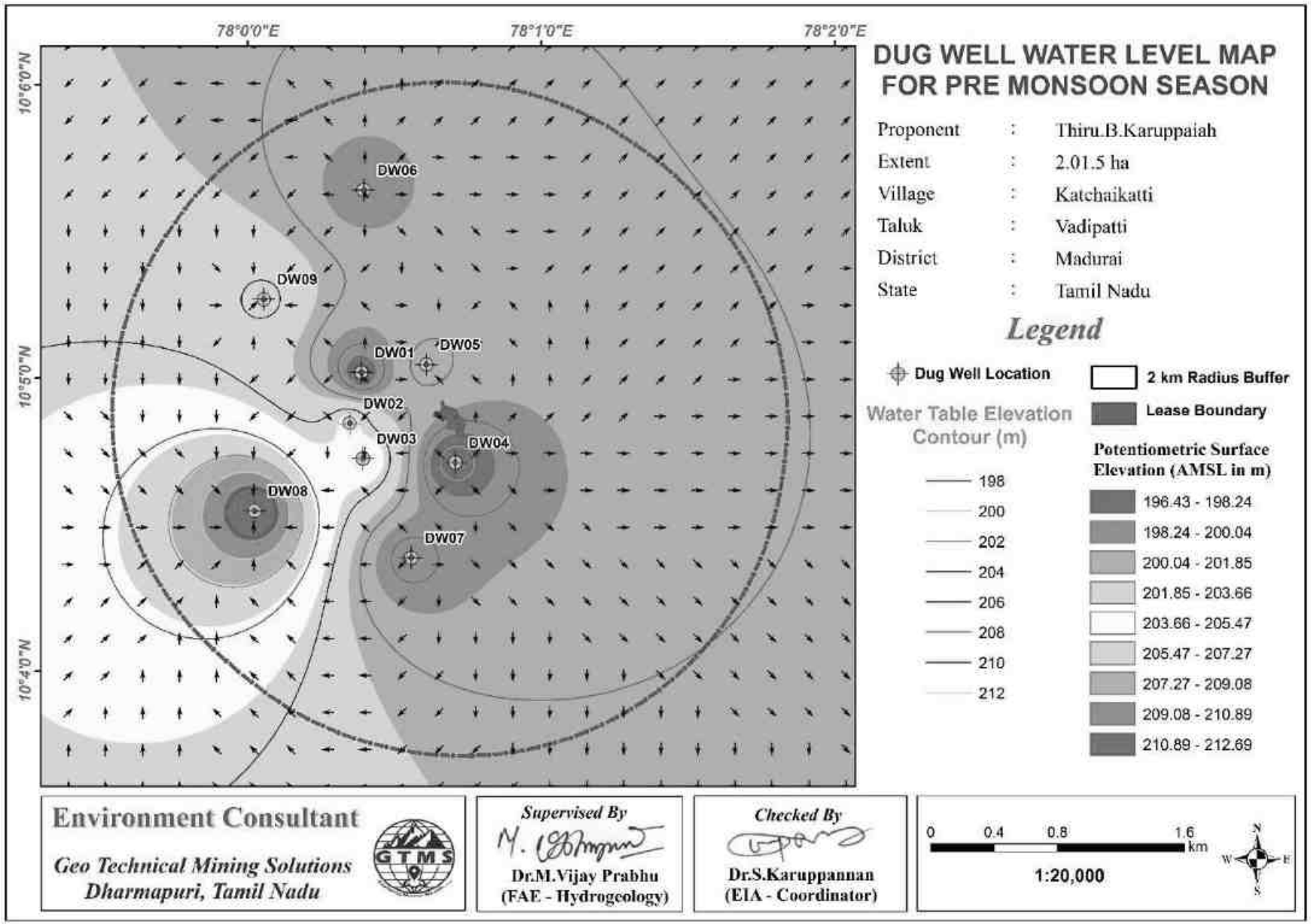


Figure 3.8 Open Well Static Groundwater Elevation Map Showing Direction of Groundwater Flow during Pre-Monsoon Season

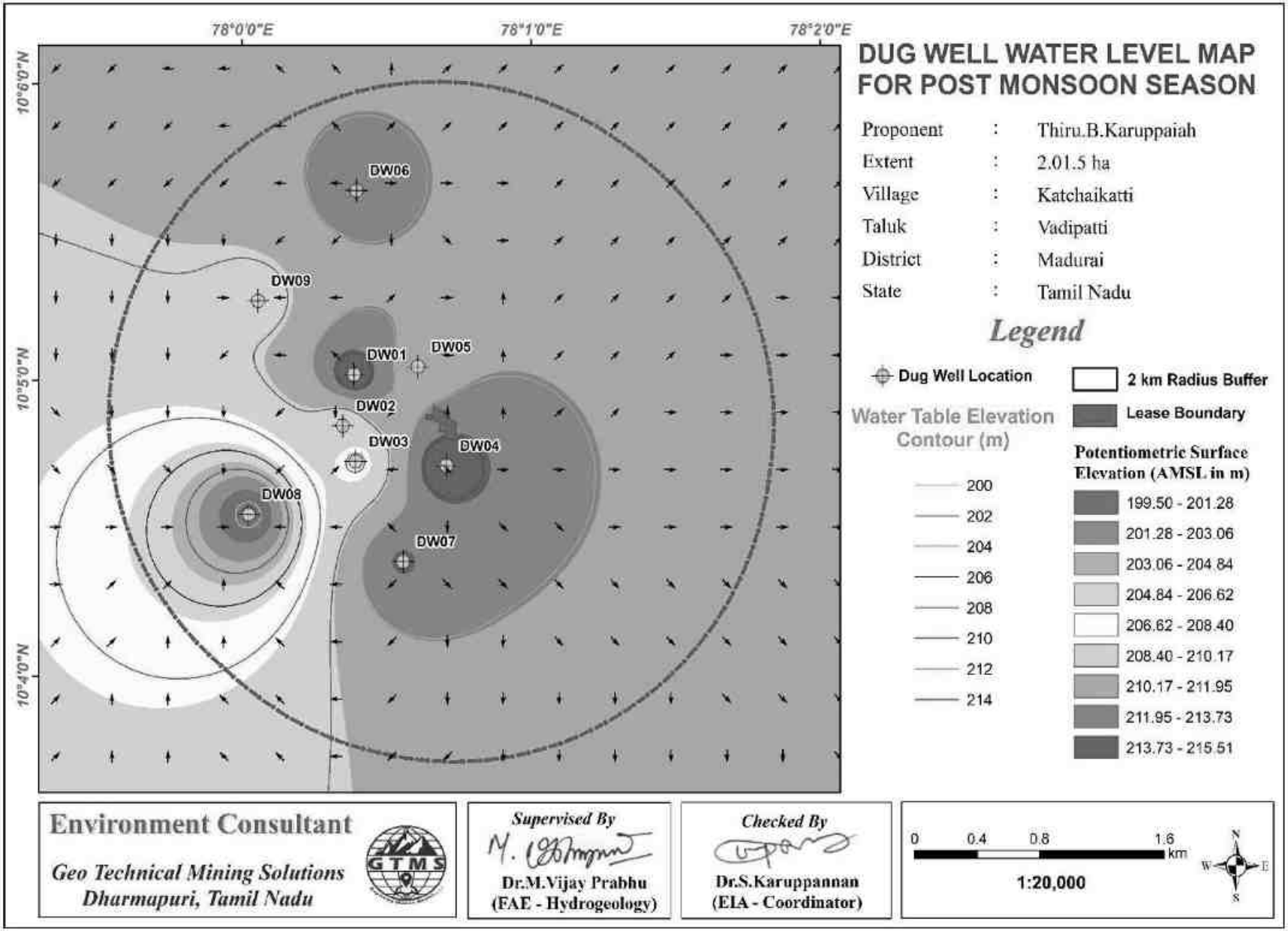


Figure 3.9 Open Well Static Groundwater Elevation Map Showing Direction of Groundwater Flow during Post-Monsoon Season

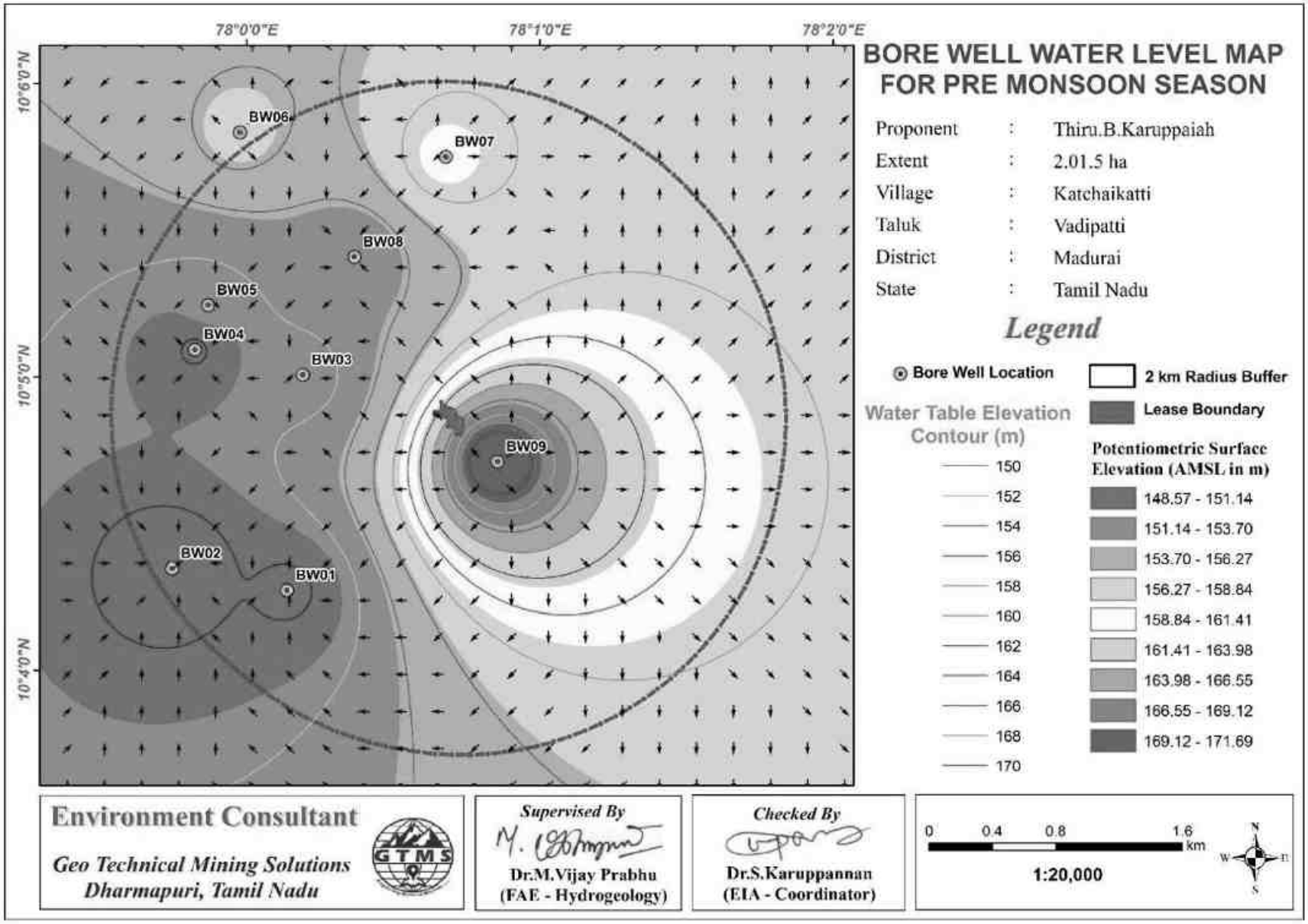


Figure 3.10 Borewell Static Groundwater Elevation Map Showing Direction of Groundwater Flow during Pre-Monsoon Season

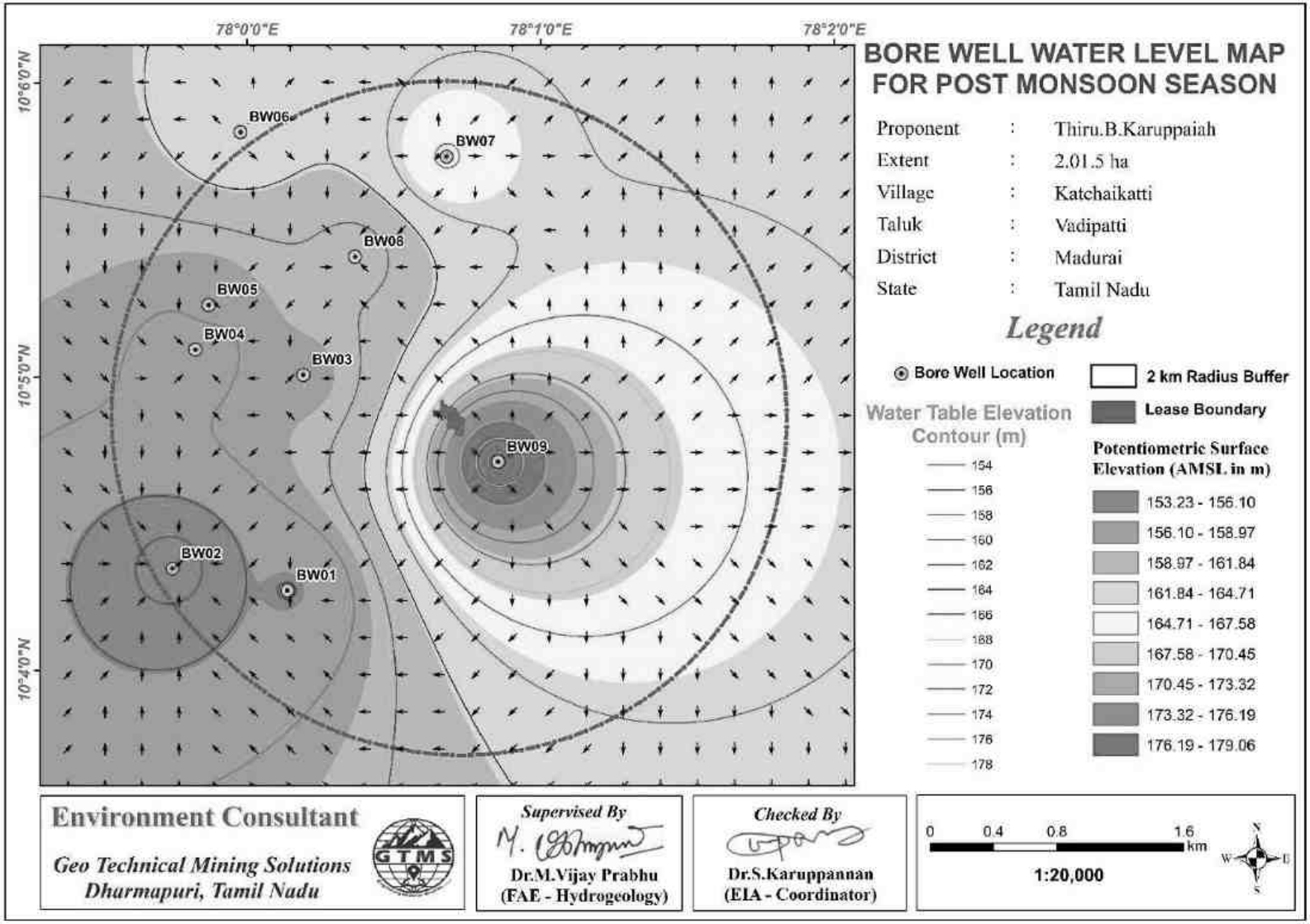


Figure 3.11 Borewell Static Groundwater Elevation Map Showing Direction of Groundwater Flow during Post-Monsoon Season

3.2.3.2 Electrical Resistivity Investigation

Electrical resistivity investigation is especially useful in the areas where there are no adequate exploratory well data about the aquifer conditions. The present study makes use of vertical electric sounding (VES) to delineate earth's subsurface layers. The electrical resistivity investigation uses four electrodes set up where current is sent through outer electrodes into the ground and the inner electrodes measure the potential difference.

Result

The Geophysical VES data obtained from the project site have been shown in Table 3.12. The field data obtained from a detailed geophysical investigation were plotted using excel spreadsheet for interpretation. The plot for the purpose of interpretation has been shown in Figure 3.11.

Table 3.12 Vertical Electrical Sounding Data

Location Coordinates - 10° 4'53.27"N 78° 0'40.92"E					
S. No.	**AB/2 (m)**	**MN/2 (m)**	**Geometrical Factor (G)**	**Resistance in Ω**	**Apparent Resistivity in Ωm**
1	5	2	16.50	0.741	125.05
2	10	2	75.43	0.245	167.91
3	15	5	62.86	0.454	288.48
4	20	5	117.86	0.326	369.37
5	25	5	188.58	0.263	496.74
6	25	10	82.50	0.594	490.67
7	30	10	125.72	0.580	582.30
8	35	10	176.79	0.406	718.27
9	40	10	235.73	0.368	876.45
10	45	10	302.51	0.355	1073.17
11	50	20	165.01	0.278	1189.65
12	60	20	251.44	0.272	786.42
13	70	20	353.59	0.269	1239.90
14	80	20	471.45	0.262	1281.12
15	90	20	605.03	0.257	1546.68
16	100	20	754.32	0.251	1785.32

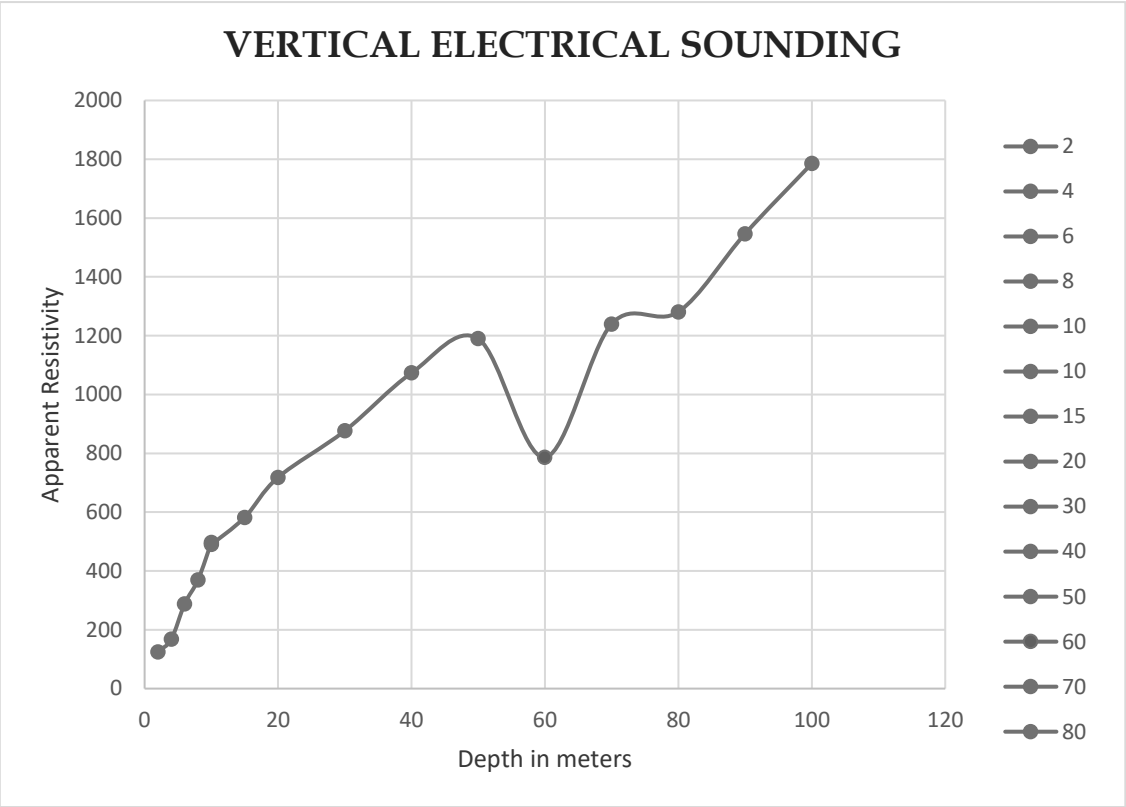


Figure 3.12 Graph Showing Occurrence of Water Bearing Fracture Zones at the Depth of 60 m Below Ground Level in Proposed Project

The rock formation of low resistivity values indicates occurrence of water at the depth of about 60 m below ground level. The maximum depth proposed for the proposed project is 20 m below ground level. Therefore, the mining operation will not affect the aquifer throughout the entire mine life period.

3.3 AIR ENVIRONMENT

The baseline studies on air environment include identification of specific air pollutants and their existing levels in ambient air. The sources of air pollution in the region are mostly due to vehicular traffic, dust arising from unpaved village road and domestic & agricultural activities.

3.3.1 Meteorology

3.3.1.1 Climatic Variables

A temporary meteorological station was installed at the project sites by covering cluster quarries. The station was installed at a height of 3 m above the ground level as there are no obstructions facilitating flow of wind, wind speed, wind direction, humidity and temperature. Meteorological data obtained from the onsite monitoring station are provided in Table 3.13.

According to the onsite data, the temperature in March 2023 varied from 17.17 to 40.12^0 C with the average of 28.64^0 C; in April, 2023 from 23.94 to 41.31^0 C with the average of 30.69^0 C; and in May, 2023 from 23.12 to 36.43^0 C with the average of 28.70^0C. In March, 2023, relative humidity ranged from 18.88 to 98.81 % with the average of 60.17%; in April, 2023, from 18.44 to 96.0 % with the average of 57.14 %; and in May, 2023, from 39.06 to 97.00 % with the average of 75.28 %. The wind speed in March, 2023 varied from 0.10 to 6.48 m/s with the average of 3.02 m/s; in April, 2023 from 0.03 to 7.26 m/s with the average of 2.88 m/s; and in May, 2023 from 0.13 to 5.06 m/s with the average of 2.19 m/s. In March,2023, wind direction varied from 0.51 to 359.18^0 with the average of 114.77^0; in April, 2023, from 0.00 to 358.83^0 with the average of 139.92^0; and in May, 2023, from 3.38 to 359.69^0 with the average of 226.68^0. In March,2023, surface pressure varied from 97.91 to 99.35 kPa with the average of 98.57 kPa; in April, 2023, from 97.66 to 99.01kPa with the average of 98.38 kPa; and in May, 2023, from 97.91 to 98.78 kPa with the average of 98.34 kPa**.**

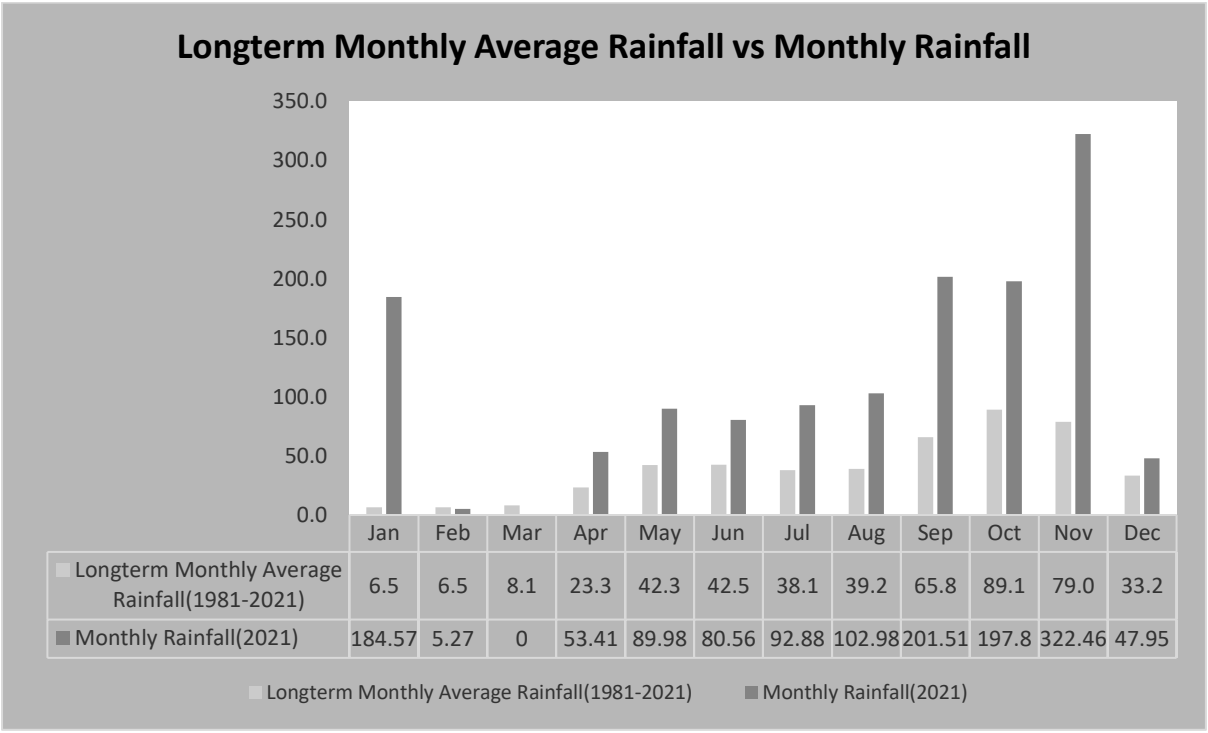
Table 3.13 Onsite Meteorological Data

S. No.	Parameters		March,2023	April,2023	May,2023
1	Temperature (^{0}C)	Min	17.17	23.94	23.12
		Max	40.12	41.31	36.43
		Avg	28.64	30.69	28.70
2	Relative Humidity (%)	Min	18.88	18.44	39.06
		Max	98.81	96.00	97.00
		Avg	60.17	57.14	75.28
3	Wind Speed (m/s)	Min	0.10	0.03	0.13
		Max	6.48	7.26	5.06
		Avg	3.02	2.88	2.19
4	Wind Direction (degree)	Min	0.51	0.00	3.38
		Max	359.18	358.83	359.69
		Avg	114.77	139.92	226.68
5	Surface Pressure(kPa)	Min	97.91	97.66	97.91
		Max	99.35	99.01	98.78
		Avg	98.57	98.38	98.34

Source: On-site monitoring/sampling by ***Accuracy Analabs*** *in association with GTMS*

Rainfall

Rainfall data for the study area were collected for the period of 1981-2021(POWER | Data Access Viewer (nasa.gov)). Long term monthly average rainfall was estimated from the data of 1981-2021 and compared with the monthly rainfall for the year 2021, shown in Figure 3.13. The Figure 3.13 shows that rainfall is generally high in the months of September through November in every year. Particularly, rainfall in September through November of 2021 is higher than the previous years.



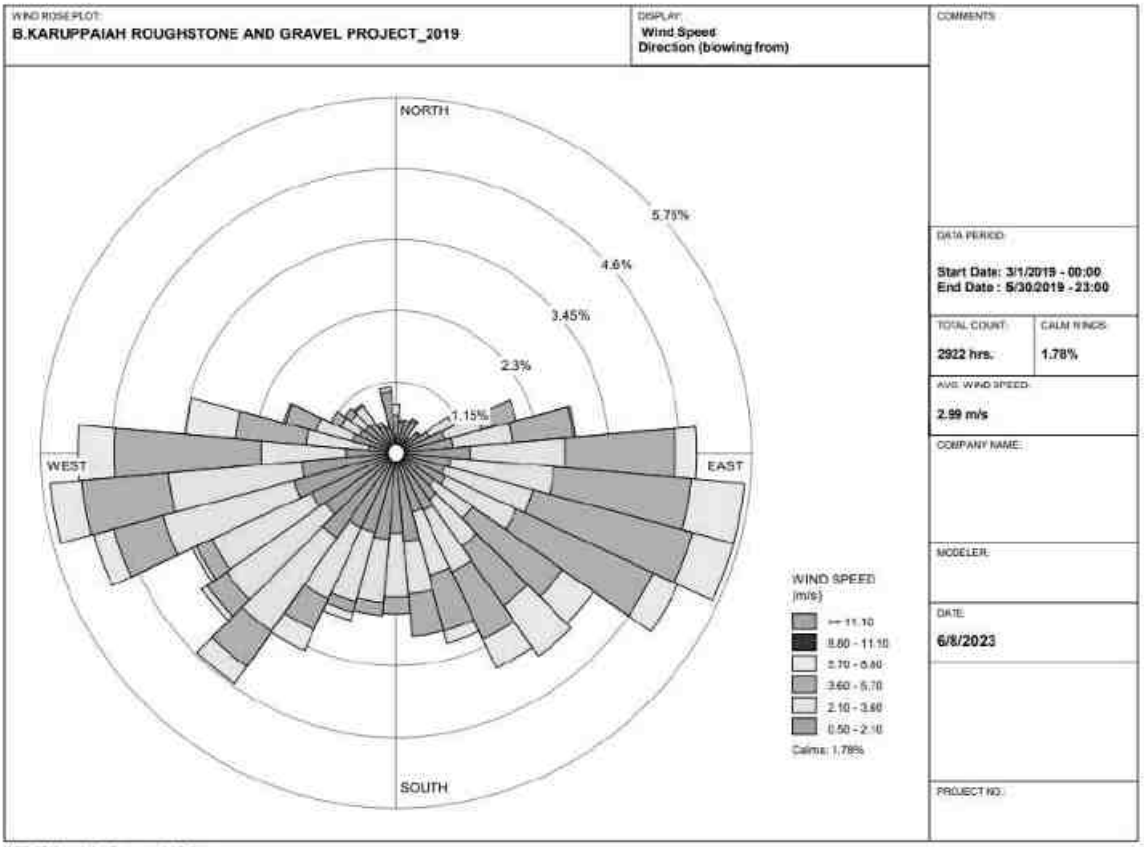
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Longterm Monthly Average Rainfall(1981-2021)	6.5	6.5	8.1	23.3	42.3	42.5	38.1	39.2	65.8	89.1	79.0	33.2
Monthly Rainfall(2021)	184.57	5.27	0	53.41	89.98	80.56	92.88	102.98	201.51	197.8	322.46	47.95

Figure 3.13 Long-Term Monthly Average Rainfall Vs Monthly Rainfall

3.3.1.2 Wind Pattern

Wind pattern will largely influence the dispersion pattern of air pollutants and noise from the proposed project site. Analysis of wind pattern requires hourly site-specific data of wind speed and direction. Two types of wind rose were generated: historical seasonal wind rose for the period of March through May of the years from 2019 to 2022 and the seasonal wind rose for the study period of March through May 2023. The wind rose diagrams thus produced are shown in Figures 3.14-3.14a. Figure 3.14 reveals that:

- ❖ The measured average wind velocity during the study period is 2.54 m/s.
- ❖ Predominant wind was dominant in the directions ranging from northwest to southeast.



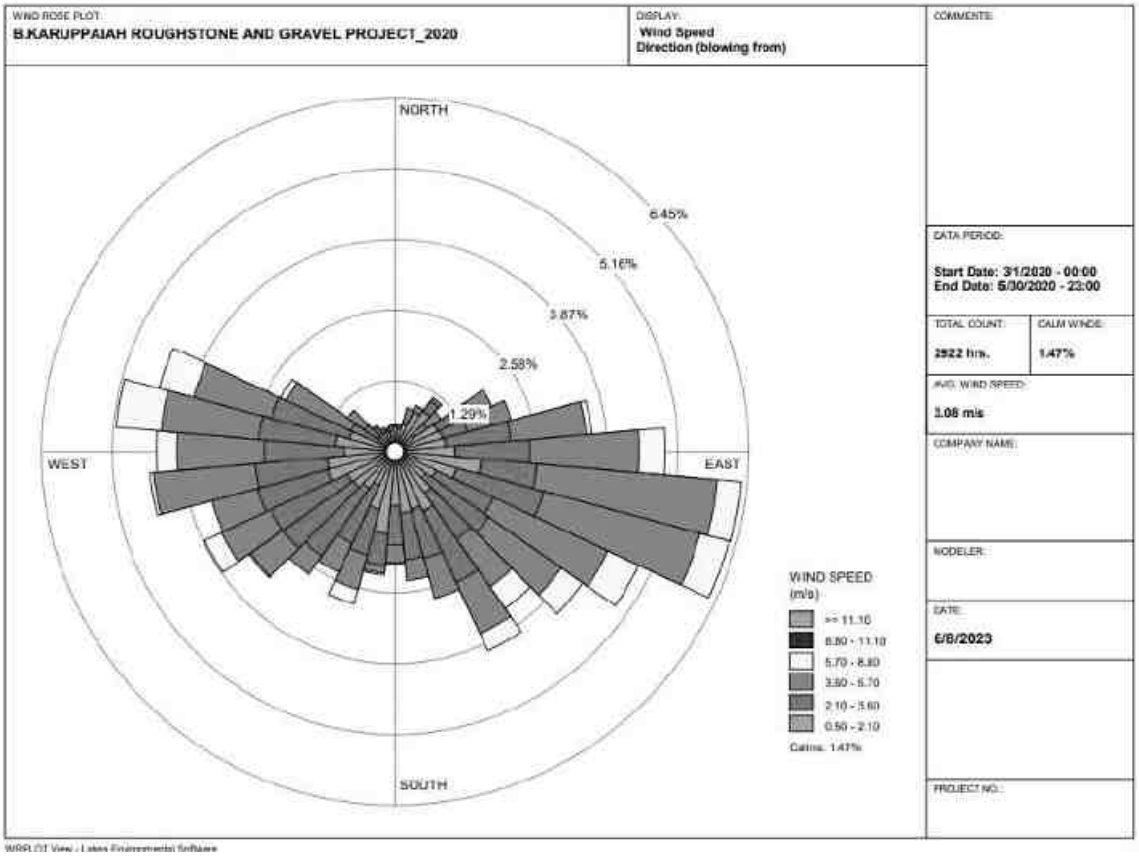
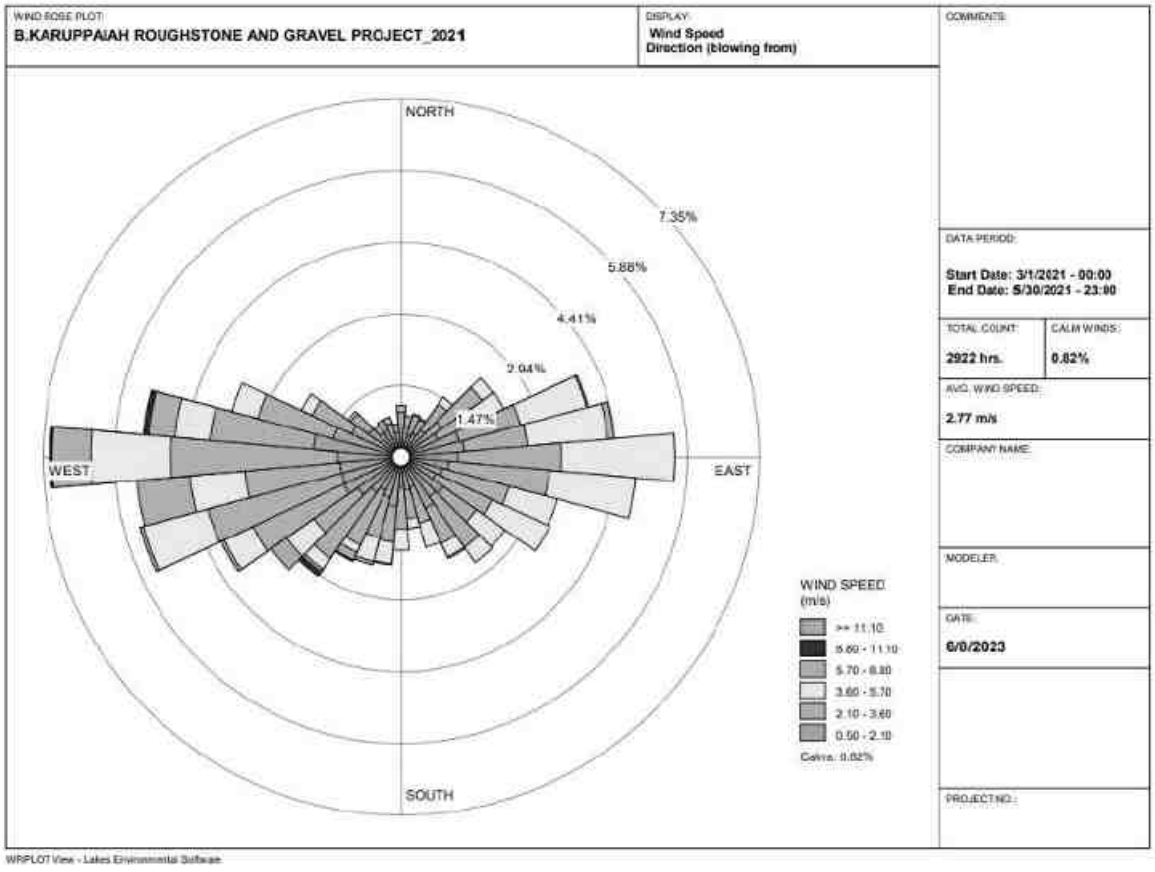


Figure 3.14 Windrose Diagram for 2019 and 2020 (March to May)



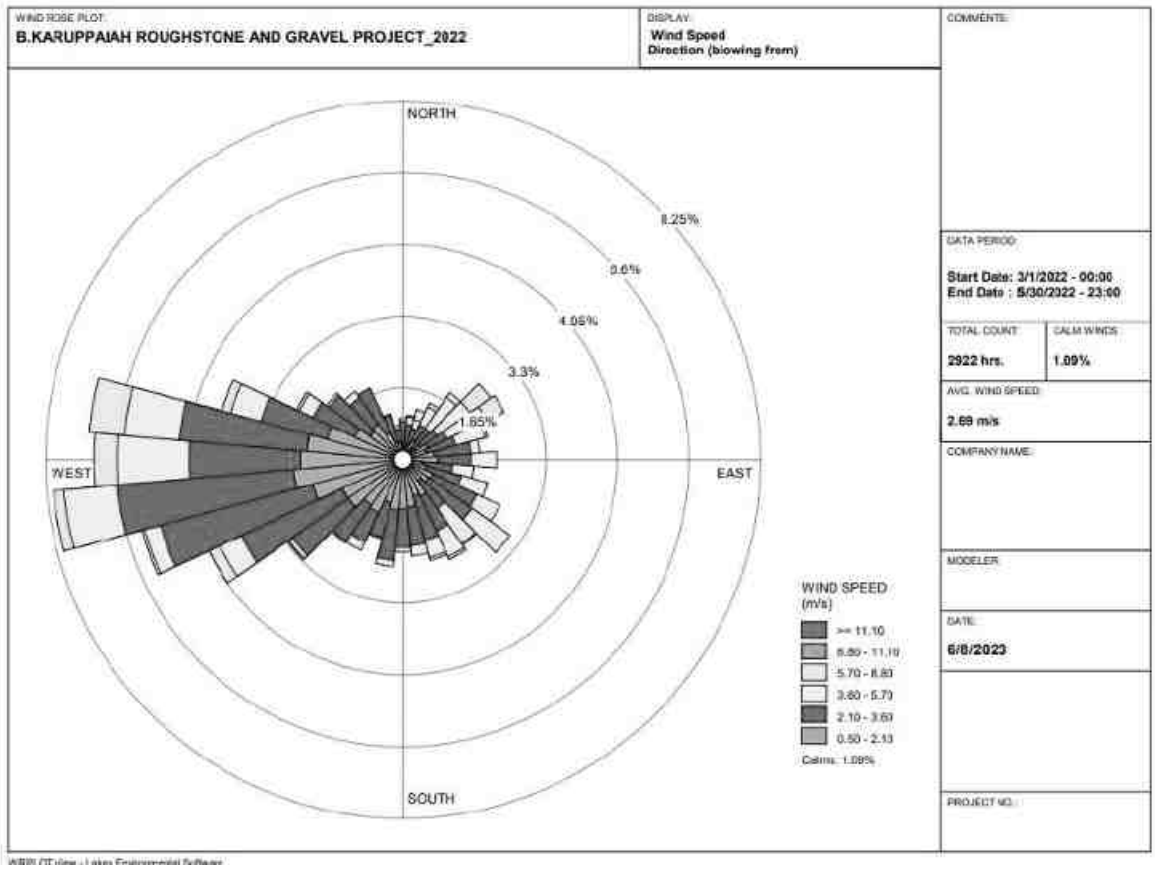


Figure 3.14a Windrose Diagram for 2021 and 2022 (March to May)

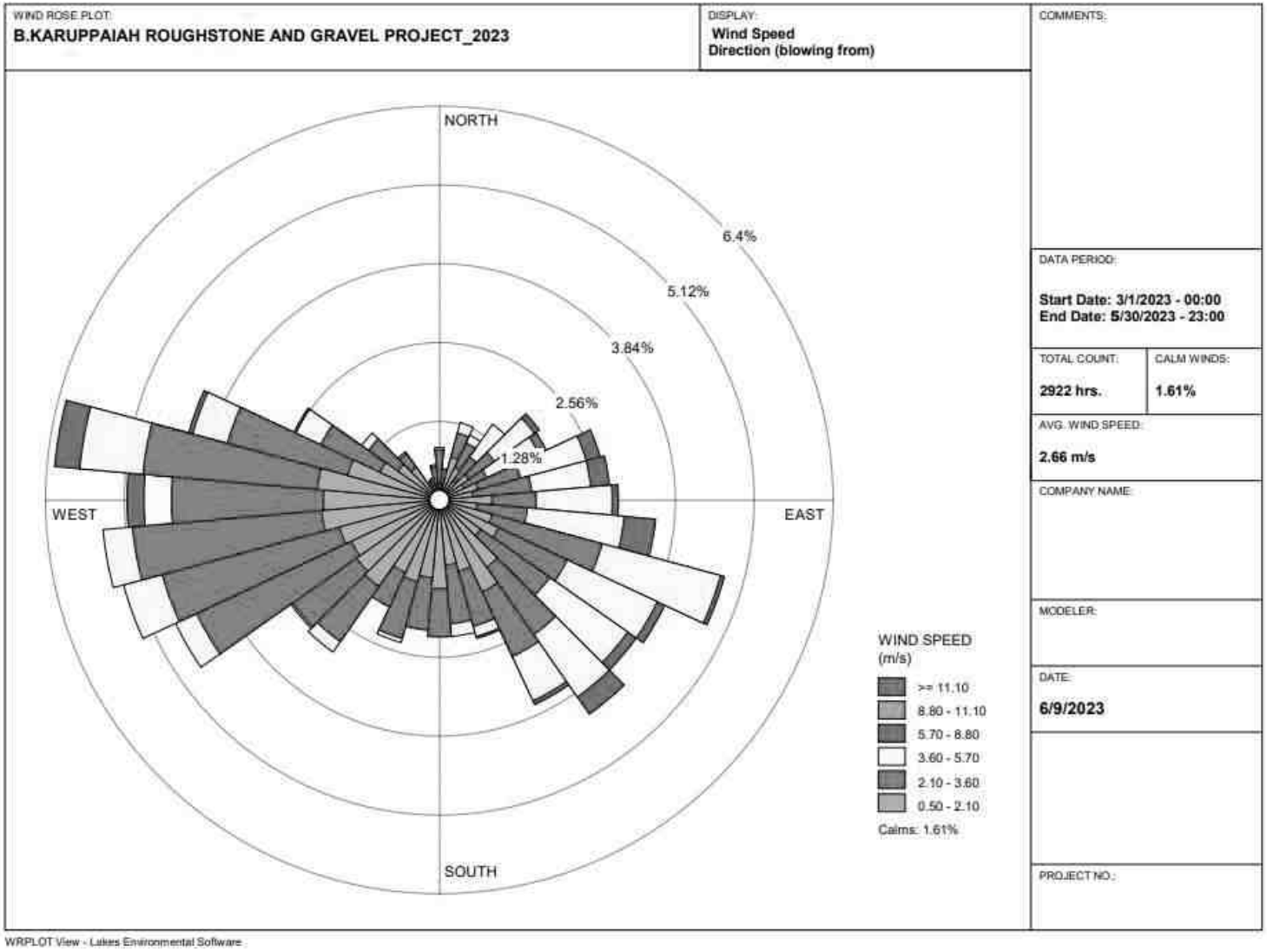


Figure 3.15 Onsite Wind Rose Diagram

3.3.2 Ambient Air Quality Study

The baseline ambient air quality is studied 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

Table 3.14 Methodology and Instrument Used for AAQ Analysis

Parameter	Method	Instrument
$PM_{2.5}$	Gravimetric method Beta attenuation method	Fine Particulate Sampler
PM_{10}	Gravimetric method Beta attenuation method	Respirable Dust Sampler
SO_2	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NOx	IS-5182 Part II (Jacob & Hoch heiser modified method)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

*Source: Sampling Methodology based on **Accuracy Analabs** & CPCB* Notification

Table 3.15 National Ambient Air Quality Standards

S. No.	Pollutant	Time Weighted Average	Concentration in ambient air	
			Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
1	SO_2 ($\mu g/m^3$)	Annual Avg.* 24 hours**	50.0 80.0	20.0 80.0
2	NO_x ($\mu g/m^3$)	Annual Avg. 24 hours	40.0 80.0	30.0 80.0
3	PM_{10} ($\mu g/m^3$)	Annual Avg. 24 hours	60.0 10°.0	60.0 10°.0
4	$PM_{2.5}$ ($\mu g/m3$)	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

Methodology

Ambient air quality monitoring was carried out with a frequency of two samples per week at Seven (7) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period March-May, 2023 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 space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results. The baseline data of ambient air were generated for $PM_{2.5}$, PM_{10}, sulphur dioxide (SO_2) and nitrogen dioxide (NO_x). The sampling locations are shown in Figure 3.16 and average concentrations of air pollutants are summarized in Tables 3.16 and are shown in Figures 3.17-3.21.

Table 3.16 Ambient Air Quality (AAQ) Monitoring Locations

S. No.	Location Code	Monitoring Locations	Distance (km)	Direction	Coordinates
1	AAQ1	Core area	---	---	10° 4'47.99"N, 78° 0'43.31"E
2	AAQ2	Ramayanpatti	0.78	W	10° 4'56.58"N, 78° 0'12.77"E
3	AAQ3	Chockalingapuram	1.95	SW	10° 4'21.72"N, 77°59'44.13"E
4	AAQ4	Vadipatti	4.84	WSW	10° 4'32.88"N, 77°58'0.08"E
5	AAQ5	Thanichiyam	4.26	S	10° 2'29.15"N, 78° 0'45.20"E
6	AAQ6	Semminipatti	2.83	NW	10° 5'50.92"N, 77°59'25.60"E
7	AAQ7	T. Mettupatti	4.90	NE	10° 6'41.70"N, 78° 2'40.13"E

Source: On-site monitoring/sampling by ***Accuracy Analabs*** *in association with GTMS*

Results

As per the monitoring data, $PM_{2.5}$ ranges from 16.9 µg/m^3 to 21.1 µg/m^3; PM_{10} from 36.3 µg/m^3 to 40.2µg/m^3; SO_2 from 5.9 µg/m^3 to 8.2 µg/m^3; NO_X from 18.1 µg/m^3 to 22.0 g/m^3. The concentration levels of the pollutants fall within the acceptable limits of NAAQS prescribed by CPCB.

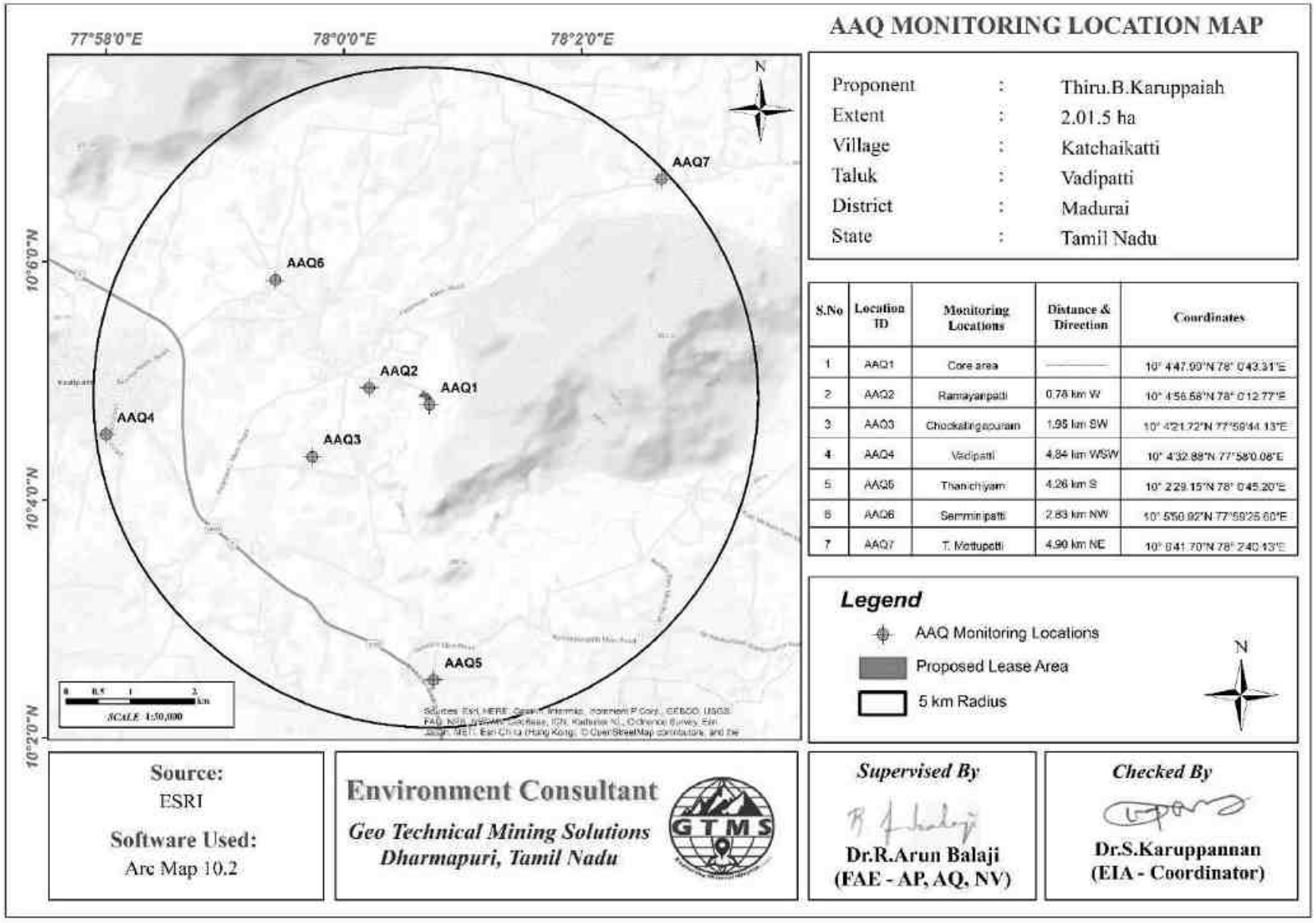


Figure 3.16 Toposheet Showing Ambient Air Quality Monitoring Station Locations Around 5 km Radius from Proposed Project Site

Table 3.17 Summary of AAQ Result

	$PM_{2.5}$				PM_{10}			
Station ID	**Max**	**Min**	**Mean**	**98th Percentile**	**Max**	**Min**	**Mean**	**98th Percentile**
AAQ1	24.7	17.2	21.1	24.1	44.8	39.6	42.6	44.8
AAQ2	23.4	19.0	21.6	23.1	42.0	36.8	39.5	42.0
AAQ3	22.3	18.3	20.4	21.1	41.7	37.9	39.8	41.7
AAQ4	19.1	12.3	16.0	19.1	39.5	34.3	37.0	39.5
AAQ5	21.9	14.0	18.0	21.6	38.8	30.2	34.9	38.5
AAQ6	20.9	16.7	19.1	20.8	39.7	33.2	37.0	39.7
AAQ7	21.1	14.3	18.0	21.1	42.2	37.0	39.7	42.2
	SO_2				NO_x			
AAQ1	10.4	6.9	8.4	10.2	18.7	12.2	16.3	18.6
AAQ2	11.0	6.9	8.9	11.0	20.1	14.2	16.9	19.9
AAQ3	10.8	8.0	9.5	10.4	20.0	13.5	16.6	19.6
AAQ4	9.6	5.2	7.0	9.4	15.1	8.6	11.0	14.4
AAQ5	10.8	5.6	8.4	10.7	20.6	12.8	17.0	20.5
AAQ6	11.9	8.8	10.0	11.6	21.8	17.3	19.1	21.8
AAQ7	9.9	5.5	7.3	9.7	18.1	11.6	14.0	15.7

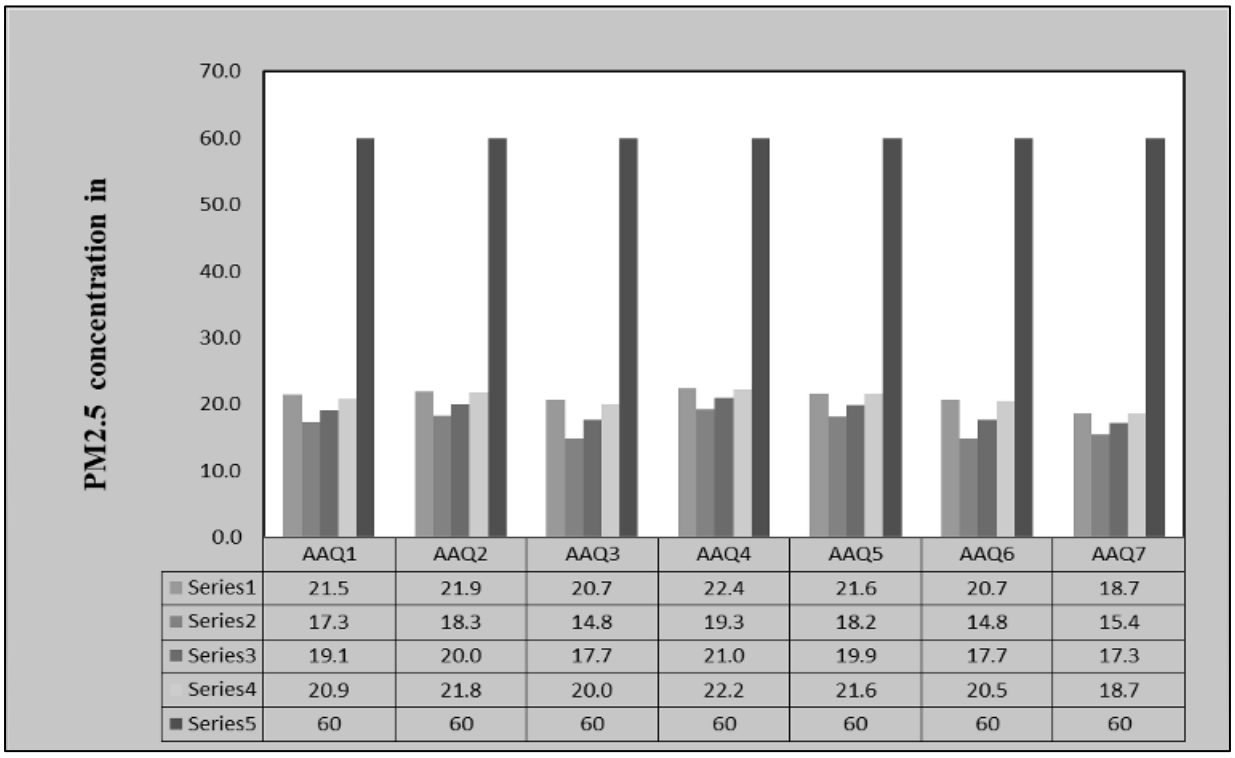
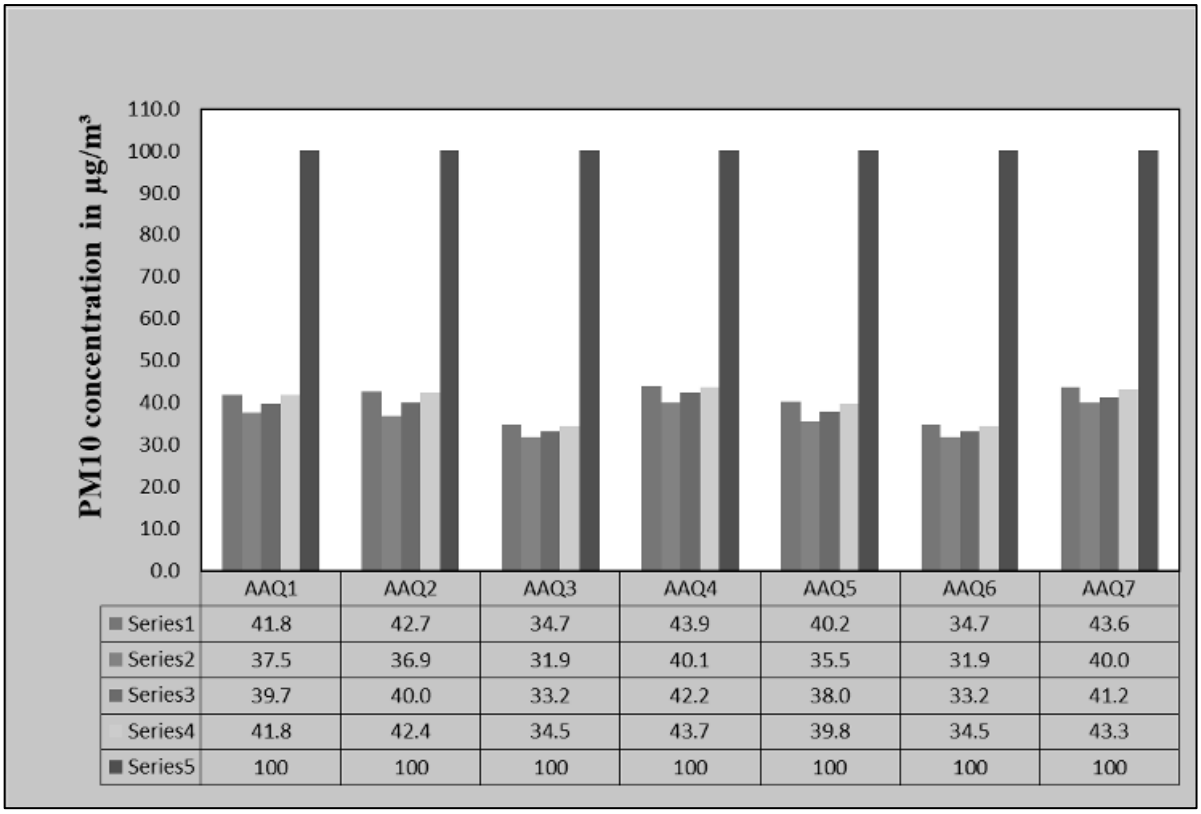
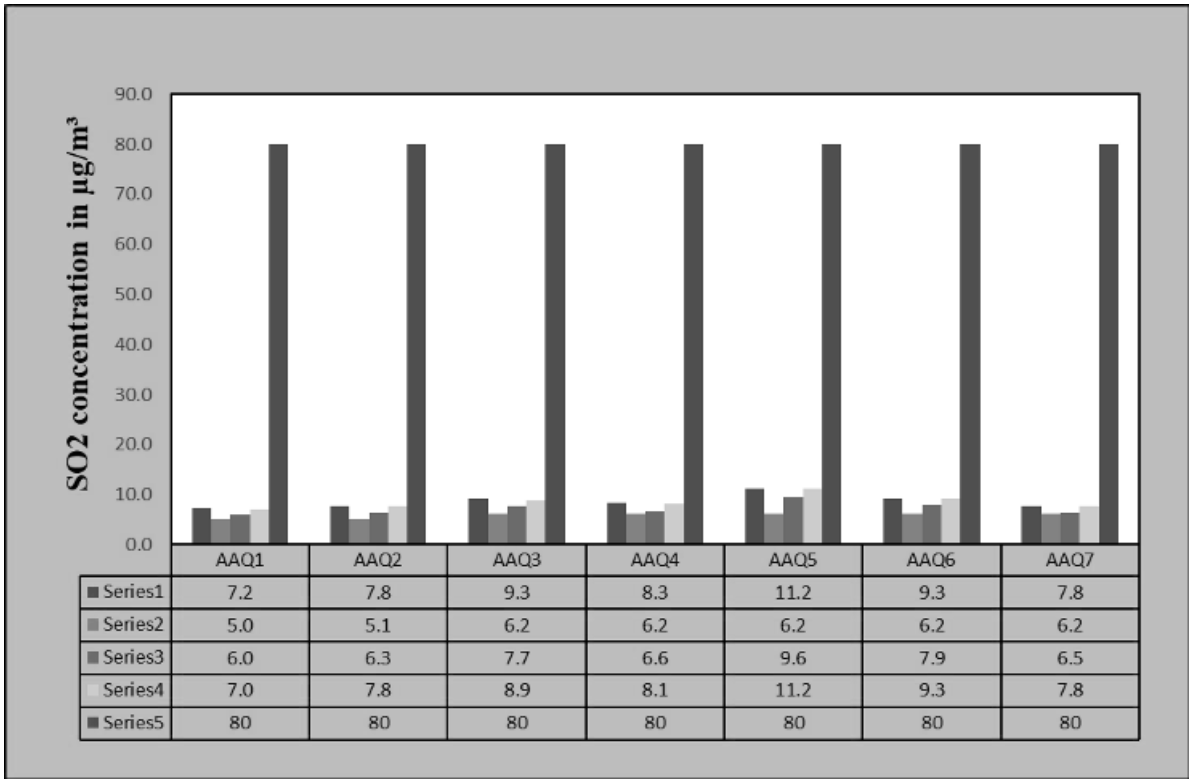


Figure 3.17 Bar Chart Showing Maximum, Minimum, and Average Concentrations of $PM_{2.5}$ Measured from 7 Air Quality Monitoring Stations within 5 km Radius



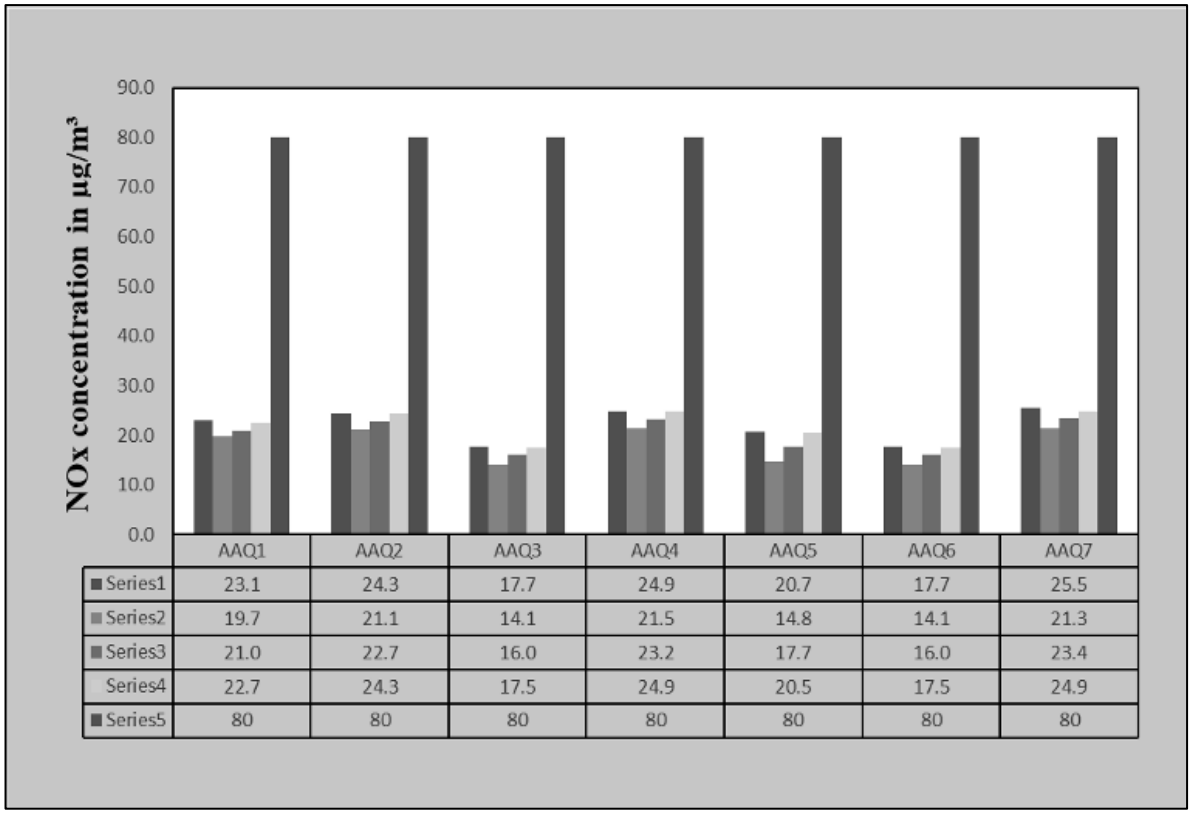
	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Series1	41.8	42.7	34.7	43.9	40.2	34.7	43.6
Series2	37.5	36.9	31.9	40.1	35.5	31.9	40.0
Series3	39.7	40.0	33.2	42.2	38.0	33.2	41.2
Series4	41.8	42.4	34.5	43.7	39.8	34.5	43.3
Series5	100	100	100	100	100	100	100

Figure 3.18 Bar Chart Showing Maximum, Minimum and Average Concentrations of PM_{10} Measured from 7 Air Quality Monitoring Stations within 5 km Radius



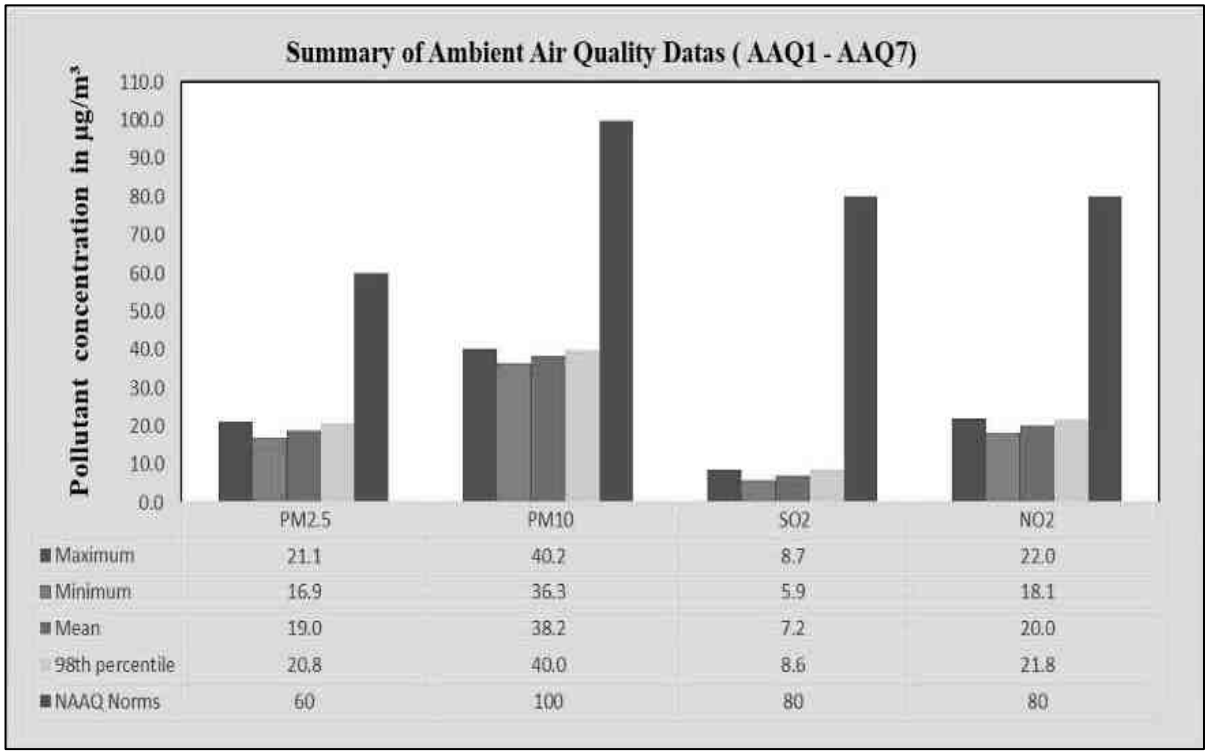
	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Series1	7.2	7.8	9.3	8.3	11.2	9.3	7.8
Series2	5.0	5.1	6.2	6.2	6.2	6.2	6.2
Series3	6.0	6.3	7.7	6.6	9.6	7.9	6.5
Series4	7.0	7.8	8.9	8.1	11.2	9.3	7.8
Series5	80	80	80	80	80	80	80

Figure 3.19 Bar Chart Showing Maximum, Minimum, and Average Concentrations of SO_2 Measured from 7 Air Quality Monitoring Stations within 5 km Radius



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Series1	23.1	24.3	17.7	24.9	20.7	17.7	25.5
Series2	19.7	21.1	14.1	21.5	14.8	14.1	21.3
Series3	21.0	22.7	16.0	23.2	17.7	16.0	23.4
Series4	22.7	24.3	17.5	24.9	20.5	17.5	24.9
Series5	80	80	80	80	80	80	80

Figure 3.20 Bar Chart Showing Maximum, Minimum and Average Concentrations of NO Measured from 7 Air Quality Monitoring Stations within 5km Radius



	PM2.5	PM10	SO2	NO2
Maximum	21.1	40.2	8.7	22.0
Minimum	16.9	36.3	5.9	18.1
Mean	19.0	38.2	7.2	20.0
98th percentile	20.8	40.0	8.6	21.8
NAAQ Norms	60	100	80	80

Figure 3.21 Bar Chart Showing Maximum, Minimum and Average Concentrations of Pollutants in Atmosphere within 5 km Radius

3.4 NOISE ENVIRONMENT

The vehicular movement on road and mining activities is the major sources of noise in the study area. The main objective of noise monitoring in the study area is to establish the baseline noise level, which will in turn be used to assess the impact of the total noise expected to be generated during the project operations around the project site. In order to assess the ambient noise levels within the study area, noise monitoring was carried out at seven (7) locations covering commercial, residential, rural areas within the radius of 5 km. Details of noise monitoring locations are provided in Table 3.18 and spatial occurrence of the locations are shown in Figure 3.24.

Table 3.18 Noise Monitoring Locations

S. No	Location Code	Monitoring Locations	Distance in km	Direction	Coordinates
1	N1	Core area	---	---	11° 0'41.52"N, 77°56'28.14"E
2	N2	Ramayanpatti	0.68	W	11° 0'42.76"N, 77°56'41.52"E
3	N3	Chockalingapuram	1.98	SW	11° 0'13.89"N, 77°56'36.49"E
4	N4	Vadipatti	4.87	WSW	11° 0'41.35"N, 77°55'36.27"E
5	N5	Thanichiyam	4.21	S	11° 0'24.93"N, 77°57'07.40"E
6	N6	Semminipatti	2.79	NW	11° 00'0.11"N, 77°56'08.14"E
7	N7	T. Mettupatti	4.91	NE	11° 00'4.03"N, 77°54'09.66"E

*Source: On-site monitoring/sampling by **Accuracy Analabs** in association with GTMS*

Table 3.19 Ambient Noise Quality Result

Station ID	Location	Environmental setting	Average day noise level (dB(A))	Average night noise level (dB(A))	Day time (6.00 AM – 10.00 PM)	Night time (10.00 PM – 6.00 AM)
					Standard (L_{eq} in dB (A))	
N1	Core area	Industrial Area	41.6	34.3	70	70
N2	Ramayanpatti	Residential Area	40.7	35.2	55	45
N3	Chockalingapuram		40.4	36.1	55	45
N4	Vadipatti		47.5	42.1	55	45
N5	Thanichiyam		39.2	33.5	55	45
N6	Semminipatti		39.8	32.6	55	45
N7	T. Mettupatti		39.5	35.2	55	45

*Source: On-site monitoring/sampling by **Accuracy Analabs** in association with GTMS*

The Table 3.18 shows that noise level in core zone was 41.6 dB (A) Leq during day time and 34.3 dB(A) Leq during night time. Noise levels recorded in buffer zone during day time varied from 39.2 to 47.5dB (A) Leq and during night time from 35.2 to 42.1 dB (A) Leq. Thus, the noise level for industrial and residential area meets the requirements of CPCB. The results are also depicted below in Figures 3.22 and 3.23.

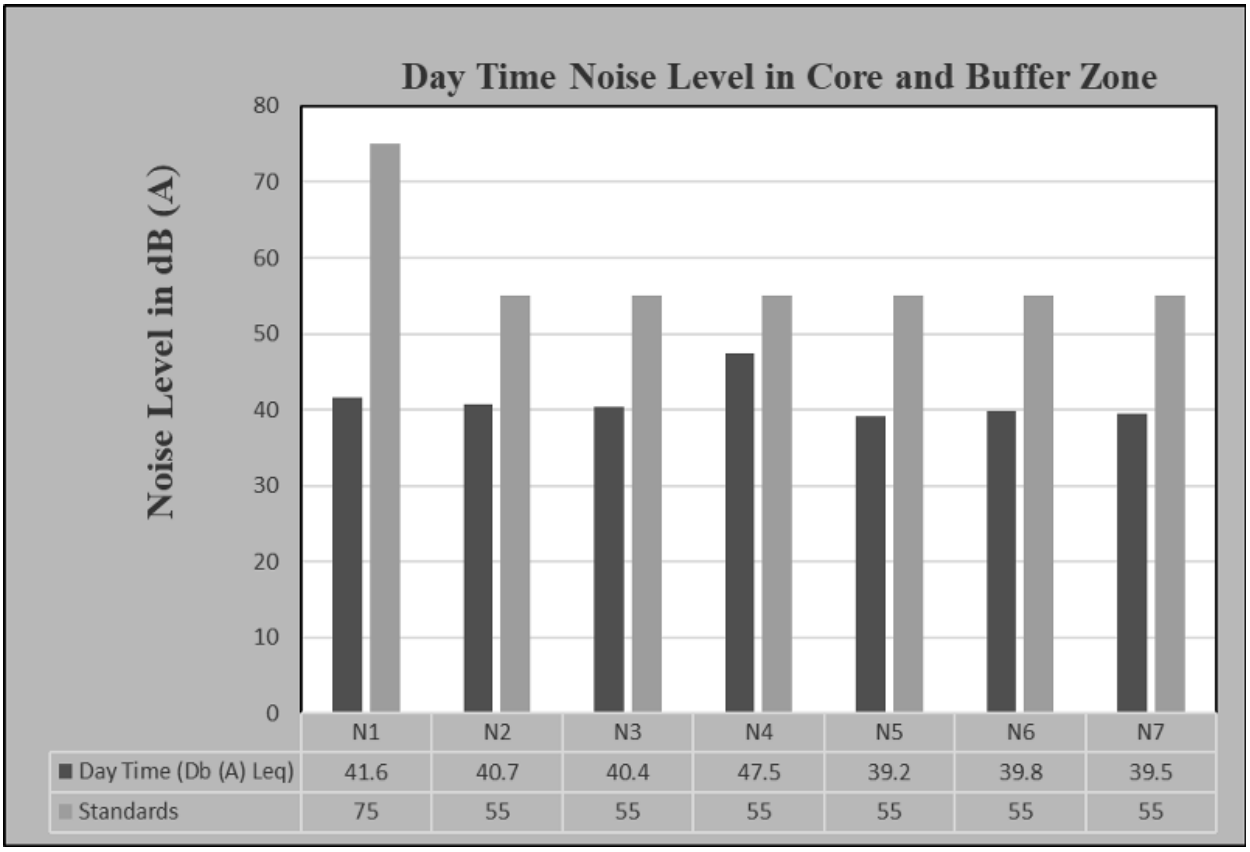


Figure 3.22 Bar Chart Showing Day Time Noise Levels Measured in Core and Buffer Zones

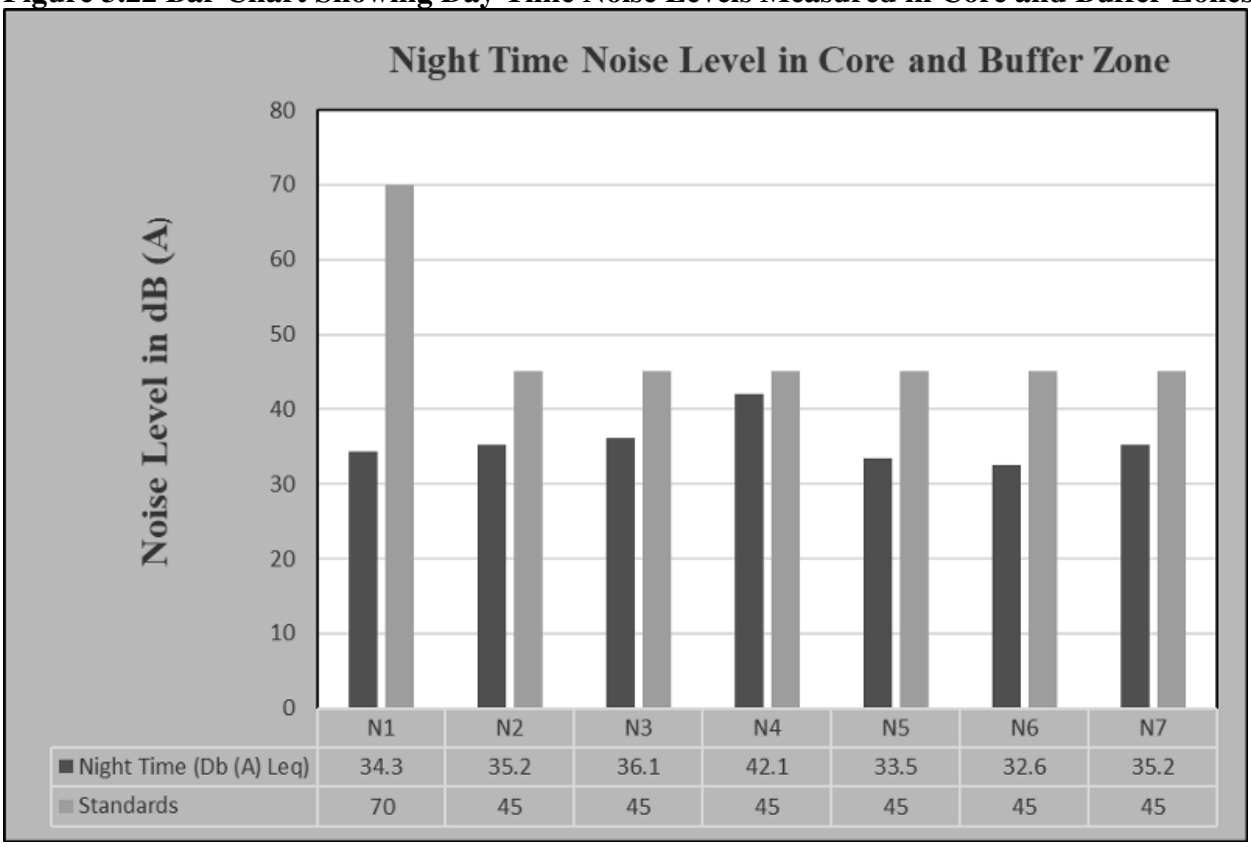


Figure 3.23 Bar Chart Showing Night Time Noise Levels Measured in Core and Buffer Zones

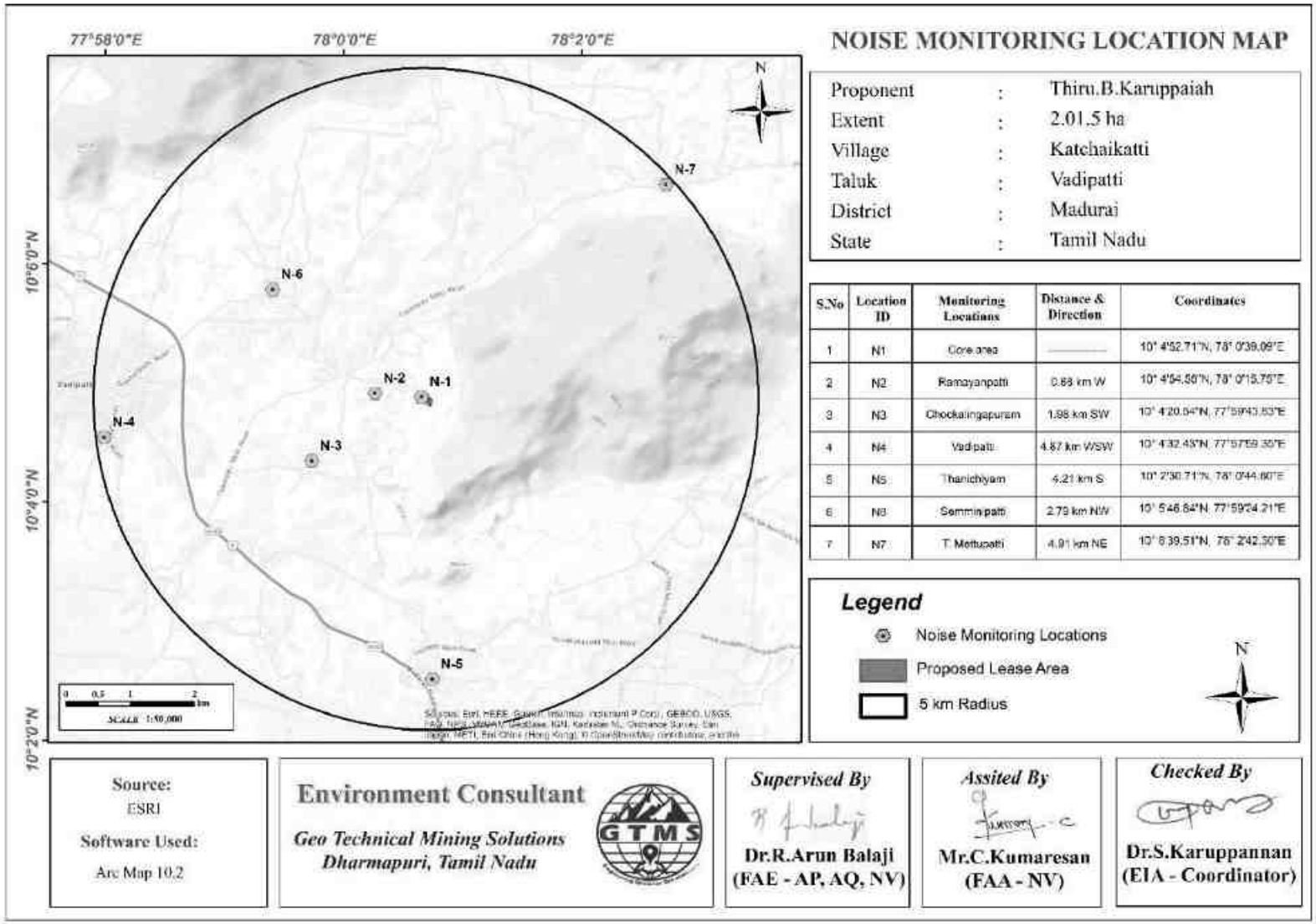


Figure 3.24 Toposheet Showing Noise Level Monitoring Station Locations around 5 km Radius from Proposed Project Site

3.5 BIOLOGICAL ENVIRONMENT

An ecological survey was conducted to collect the baseline data regarding flora and fauna in the study area of 10 km radius. Data were also collected from different sources, i.e., government departments such as District Forest Office, Government of Tamil Nadu. On the basis of onsite observations as well as forest department records the checklist of flora and fauna was prepared.

Methodology

Sampling locations were selected with reference to topography, land use, vegetation pattern, etc. In this study**,** quadrats of 25 m × 25 m were laid down to assess trees and quadrats of 10 m × 10 m were laid down for shrubs, as shown in Figure 3.25.

Figure 3.25 Quadrates Sampling Methods of Flora

Phyto-Sociological Studies

Phyto sociological parameters, such as ***Density, Frequency, Abundance and Importance Value Index*** of individual species were determined in randomly placed quadrat of different sizes in the study area, as shown in Table 3.20. Relative frequency, and relative density were calculated and the sum of these three represented Importance Value Index (IVI) for various species. For shrubs, herbs and grasses, ***Density, Frequency, Relative Density & Relative Frequency were found***. Sample plots were selected in such a way to get maximum representation of different types of vegetation and plots were laid out in different part of the study area of 10 km radius. Analysis of the vegetation will help in determining the relative importance of each species in the study area and to reveal if any economically valuable species is threatened in the process.

Table 3.20 Calculation of Density, Frequency (%), Dominance, Relative Density, Relative Frequency, Relative Dominance & Important Value Index

Parameters	Formula
Density	Total No. of individuals of species/ Total No. of Quadrats used in sampling
Frequency (%)	(Total No. of Quadrats in which species occur/ Total No. of Quadrats studied)100
Abundance	Total No. of individuals of species/ No. of Quadrats in which they occur
Relative Density	(Total No. of individuals of species/Sum of all individuals of all species) * 100
Relative Frequency	(Total No. of Quadrats in which species occur/ Total No. of Quadrats occupied by all species) * 100
Important Value Index	Relative Density + Relative Frequency

Shannon – Wiener Index, Evenness and Richness

Biodiversity index is a quantitative measure that reflects how many different types of species, there are in a dataset, and simultaneously takes into account how evenly the basic entities (such as individuals) are distributed among those types of species. The value of biodiversity index increases both when the number of types increases and when evenness increases. For a given number of type of species, the value of a biodiversity index is maximized when all type of species is equally abundant. The corresponding formulas are given in Table 3.21.

Table 3.21 Calculation of Species Diversity by Shannon – Wiener Index, Evenness and Richness

Description	Formula
Species diversity – Shannon – Wien Index	**$H = \sum[(p_i)*\ln(p_i)]$** Where p_i: Proportion of total sample represented by species i: number of individuals of species i/ total number samples
Evenness	H/H max H_{max} = ln(s)= maximum diversity possible S=No. of species
Species Richness by Margalef	RI = S-1/ln N Where S = Total Number of species in the community N = Total Number of individuals of all species in the Community

3.5.1 Flora

Flora study was conducted using the above said methodology to inventory the existing terrestrial plants in both core and buffer zones. Details of plants have been described in the succeeding sections. Photographs showing various species are provided in Figure 3.28.

Crop Patterns in Katchaikatti Village

The principal crops are Paddy, Millet, Pulses, Cotton cultivated in Madurai district. Cholam, Combu, Ragi, Maize, Varagu, Samai, Red Gram, Blackgram, Horse gram and Greengram under irrigated and rain fed conditions.

Flora in mine lease area (core zone)

Prosophis juliflora is the most common weed. The mine lease area contains total of 6 species belonging to 4 families have been recorded from the mine lease area. 1 Tree, 2 shrubs, 3 herbs were identified. It is a grassy land. There are no endangered species in mine lease area. Details of vegetation with scientific name indicated in Table 3.22.

Table 3.22 Flora in mine lease area

Local name	Scientific name	Family name	No of Trees
Trees			
Karuvealan	*Prosopis juliflora*	Fabaceae	8
Shrubs			
Avaram chadi	*Senna auriculata*	Fabaceae	4
Earuku	*Calotropis gigantea*	Apocynaceae	3
Herbs /Climber			
Perandai	*Cissus quadrangularis*	Vitaceae	5
Thathapondu	*Tridax procumbens*	Asteraceae	10
Kolunji chadi	*Tephrosia purpurea*	Fabaceae	12

The Flora in lease area and 300 m radius (buffer zone)

There is no agricultural land nearby lease area. It contains a total of 41 species belonging to 23 families have been recorded from the buffer zone. 11 Trees (26.8%), 8 Shrubs (19.5%) and 22 Herbs and Climbers, Creeper, Grass & Cactus (53.7%) were identified. Details of flora with the scientific name details and of diversity species Rich ness index were mentioned in Table 3.23-3.25 and Figure 3.26. There is no threat to the Flora species in 300 m radius.

Flora in 10 km radius buffer zone

Similar type of environment also in buffer area but with more flora diversity compare than core zone area. It contains a total of species belonging to 43 families have been recorded from the buffer zone. The floral (109) varieties among them 45 Trees (41.28%), 21 Shrubs (19.26%) Herbs and Climbers, Creeper, Grass & Cactus, 43 (39.44%) were identified. Details of flora with the scientific name details of diversity species Rich ness index were mentioned in Table 3.26-3.28 and Figure 3.27.

Table 3.23 Flora in 300 m Radius

S.No.	Local Name	Scientific name	Family name	Total No. of species	Total of Quadrants with species	Total No. of Quadrants	Density	Frequency (%)	Abundance	Relative Density	Relative Frequency	IVI	IUCN Conservation Status
Trees													
1	Karuvealan	*Prosopis juliflora*	Fabaceae	4	3	5	0.8	60.0	1.3	9.3	9.4	18.7	Not Listed
2	Palm tree	*Borassus flabellifer*	Fabaceae	3	2	5	0.6	40.0	1.5	7.0	6.3	13.2	Not Listed
3	Vembu	*Azadirachta indica*	Meliaceae	5	4	5	1.0	80.0	1.3	11.6	12.5	24.1	Not Listed
4	Vealli vealan	*Vachellia leucophloea*	Babesiae	3	2	5	0.6	40.0	1.5	7.0	6.3	13.2	Not Listed
5	Unjai maram	*Albizia amara*	Fabaceae	4	3	5	0.8	60.0	1.3	9.3	9.4	18.7	Not Listed
6	Vetpalai	*Wrightia tinctoria*	Apocynaceae	5	4	5	1.0	80.0	1.3	11.6	12.5	24.1	Not Listed
7	Teke	*Tectona grandis*	Verbenaceae	4	3	5	0.8	60.0	1.3	9.3	9.4	18.7	Not Listed
8	Allamaram	*Ficus benghalensis*	Morassie	3	2	5	0.6	40.0	1.5	7.0	6.3	13.2	Not Listed
9	Pungamaram	*Pongamia pinnata*	Fabaceae	5	4	5	1.0	80.0	1.3	11.6	12.5	24.1	Not Listed
10	Piliyamaram	*Tamarindus indica*	Fabaceae	3	2	5	0.6	40.0	1.5	7.0	6.3	13.2	Not Listed
11	Theannaimaram	*Cocos nucifera*	Arecaceae	4	3	5	0.8	60.0	1.3	9.3	9.4	18.7	Not Listed
Shrubs													
1	Erukku	*Calotropis gigantea*	Apocynaceae	6	5	10	0.6	50.0	1.2	10.3	10.0	20.3	Not Listed
2	Uumaththai	*Datura metel*	Solanaceae	7	6	10	0.7	60.0	1.2	12.1	12.0	24.1	Not Listed
3	Thuthi	*Abutilon indicum*	Meliaceae	8	7	10	0.8	70.0	1.1	13.8	14.0	27.8	Not Listed
4	Avarai	*Senna auriculata*	Fabaceae	9	8	10	0.9	80.0	1.1	15.5	16.0	31.5	Not Listed
5	Unichadi	*Lantana camara*	Verbenaceae	6	5	10	0.6	50.0	1.2	10.3	10.0	20.3	Not Listed

6	suraimullu	*Zizyphus Oenoplia*	Rhamnaceae	7	6	10	0.7	60.0	1.2	12.1	12.0	24.1	Not Listed
7	Nochi	*Vitex negundo*	Lamiaceae	8	7	10	0.8	70.0	1.1	13.8	14.0	27.8	LC
8	Veralichadi	*Dodonaea viscosa*	Sapindaceae	7	6	10	0.7	60.0	1.2	12.1	12.0	24.1	Not Listed
Herbs													
1	Nayuruv	*Achyranthes aspera*	Amaranthaceae	6	5	15	0.4	33.3	1.2	3.7	3.5	7.2	Not Listed
2	Nearunji mull	*Tribulus zeyheri* Sond	Zygophyllaceae	7	6	15	0.5	40.0	1.2	4.3	4.3	8.5	
3	pill	*Cenchrus ciliaris*	Poaceae	5	4	15	0.3	26.7	1.3	3.1	2.8	5.9	Not Listed
4	pulapoo	*Aerva lanata*	Amaranthaceae	8	7	15	0.5	46.7	1.1	4.9	5.0	9.9	Not Listed
5	kapok bush	*Aerva javani*	Amaranthaceae	7	6	15	0.5	40.0	1.2	4.3	4.3	8.5	Not Listed
6	Rail poondu	*Croton bonplandianus*	Euphorbiaceae	8	7	15	0.5	46.7	1.1	4.9	5.0	9.9	Not Listed
7	Yanai neariji	*pedalium murex*	Pedaliaceae	6	5	15	0.4	33.3	1.2	3.7	3.5	7.2	Not Listed
8	Perandai	*Cissus quadrangularis*	Vitaceae	9	8	15	0.6	53.3	1.1	5.5	5.7	11.2	Not Listed
9	Thumbai chadi	*Leucas aspera*	Lamiaceae	7	6	15	0.5	40.0	1.2	4.3	4.3	8.5	Not Listed
10	Umathai	*Datura metel*	Solanaceae	8	7	15	0.5	46.7	1.1	4.9	5.0	9.9	Not Listed
11	Sethamutti	*Sida cordata*	Malvaceae	6	5	15	0.4	33.3	1.2	3.7	3.5	7.2	Not Listed
12	Annanm	*Iva annua*	Asteraceae	7	6	15	0.5	40.0	1.2	4.3	4.3	8.5	Not Listed
13	Kolunji	*Tephrosia purpurea*	Fabaceae	9	8	15	0.6	53.3	1.1	5.5	5.7	11.2	Not Listed
14	Nayuruvi	*Achyranthes aspera*	Amaranthaceae	8	7	15	0.5	46.7	1.1	4.9	5.0	9.9	Not Listed
15	Ishappukol Vitai	*Plantago coronopus*	Plantaginaceae	6	5	15	0.4	33.3	1.2	3.7	3.5	7.2	Not Listed
16	vealiparuthi	*Pergularia daemia*	Apocynaceae	8	7	15	0.5	46.7	1.1	4.9	5.0	9.9	Not Listed
17	Seppu nerinji	*Indigofera linnaei Ali*	Fabaceae	7	6	15	0.5	40.0	1.2	4.3	4.3	8.5	Not Listed
18	Sapathikalli	*Opuntia ficus-indica*	Cactaceae	9	8	15	0.6	53.3	1.1	5.5	5.7	11.2	Not Listed
19	Pal kodi	*Cynanchum viminale*	Apocynaceae	8	7	15	0.5	46.7	1.1	4.9	5.0	9.9	Not Listed
20	Ilia perandai	*Cissus rotundifolia*	Vitaceae	9	8	15	0.6	53.3	1.1	5.5	5.7	11.2	Not Listed
21	Katralai	*Aloe vera*	Asphodelaceae	8	7	15	0.5	46.7	1.1	4.9	5.0	9.9	Not Listed
22	Seammulli	*Barleria prionitis*	Acanthaceae	7	6	15	0.5	40.0	1.2	4.3	4.3	8.5	Not Listed

Table 3.24 Calculation of Species Diversity in 300 m Radius

S.No.	Common name	Scientific name	No. of Species	Pi	In (Pi)	Pi x in (Pi)
Trees						
1	Karuvealan	*Prosopis juliflora*	4	0.09	-2.37	-0.22
2	Palm tree	*Borassus flabellifer*	3	0.07	-2.66	-0.19
3	Vembu	*Azadirachta indica*	5	0.12	-2.15	-0.25
4	Vealli vealan	*Vachellia leucophloea*	3	0.07	-2.66	-0.19
5	Unjai maram	*Albizia amara*	4	0.09	-2.37	-0.22
6	Vetpalai	*Wrightia tinctoria*	5	0.12	-2.15	-0.25
7	Teke	*Tectona grandis*	4	0.09	-2.37	-0.22
8	Allamaram	*Ficus benghalensis*	3	0.07	-2.66	-0.19
9	Pungamaram	*Pongamia pinnata*	5	0.12	-2.15	-0.25
10	Piliyamaram	*Tamarindus indica*	3	0.07	-2.66	-0.19
11	Theannaimaram	*Cocos nucifera*	4	0.09	-2.37	-0.22
H (Shannon Diversity Index) =2.38						
Shrubs						
1	Erukku	*Calotropis gigantea*	6	0.10	-2.27	-0.23
2	Uumaththai	*Datura metel*	7	0.12	-2.11	-0.26
3	Thuthi	*Abutilon indicum*	8	0.14	-1.98	-0.27
4	Avarai	*Senna auriculata*	9	0.16	-1.86	-0.29
5	Unichadi	*Lantana camara*	6	0.10	-2.27	-0.23
6	suraimullu	*Zizyphus Oenoplia*	7	0.12	-2.11	-0.26
7	Nochi	*Vitex negundo*	8	0.14	-1.98	-0.27
8	Veralichadi	*Dodonaea viscosa*	7	0.12	-2.11	-0.26
H (Shannon Diversity Index) =2.07						
Herbs						
1	Nayuruv	*Achyranthes aspera*	6	0.04	-3.30	-0.12
2	Nearunji mull	*Tribulus zeyheri Sond*	7	0.04	-3.15	-0.14
3	Pill	*Cenchrus ciliaris*	5	0.03	-3.48	-0.11
4	Pulapoo	*Aerva lanata*	8	0.05	-3.01	-0.15
5	Kapok bush	*Aerva javani*	7	0.04	-3.15	-0.14
6	Rail poondu	*Croton bonplandianus*	8	0.05	-3.01	-0.15
7	Mookuthi poondu	*pedalium murex*	6	0.04	-3.30	-0.12
8	Perandai	*Cissus quadrangularis*	9	0.06	-2.90	-0.16

9	Thumbai chadi	*Leucas aspera*	7	0.04	-3.15	-0.14
10	Umathai	*Datura metel*	8	0.05	-3.01	-0.15
11	Sethamutti	*Sida cordata*	6	0.04	-3.30	-0.12
12	Annanm	*Iva annua*	7	0.04	-3.15	-0.14
13	Kolunji	*Tephrosia purpurea*	9	0.06	-2.90	-0.16
14	Nayuruvi	*Achyranthes aspera*	8	0.05	-3.01	-0.15
15	Ishappukol Vitai	*Plantago coronopus*	6	0.04	-3.30	-0.12
16	Vealiparuthi	*Pergularia daemia*	8	0.05	-3.01	-0.15
17	Seppu nerinji	*Indigofera linnaei Ali*	7	0.04	-3.15	-0.14
18	Sapathikalli	*Opuntia ficus-indica*	9	0.06	-2.90	-0.16
19	Pal kodi	*Cynanchum viminale*	8	0.05	-3.01	-0.15
20	Ilia perandai	*Cissus rotundifolia*	9	0.06	-2.90	-0.16
21	Katralai	*Aloe vera*	8	0.05	-3.01	-0.15
22	Seammulli	*Barleria prionitis*	7	0.04	-3.15	-0.14
H (Shannon Diversity Index) =3.08						

Table 3.25 Species Richness (Index) in 300-meter radius

Details	H	H max	Evenness	Species Richness
Tree	2.38	2.40	0.99	2.66
Shrubs	2.07	2.08	1.00	1.72
Herbs	3.08	3.09	1.00	4.12

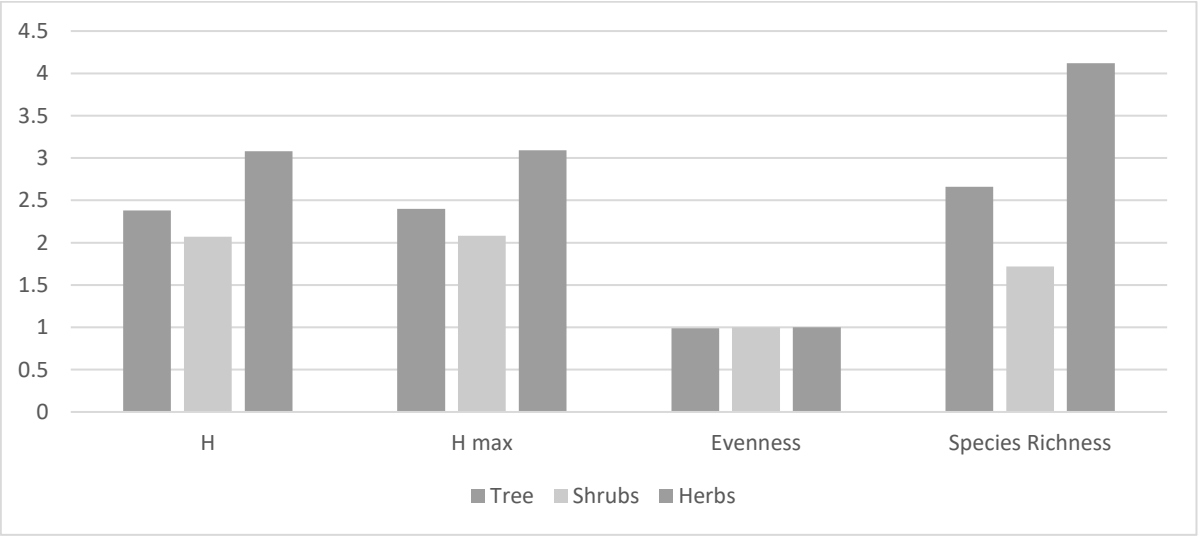


Figure. 3.26 Species Richness (Index) in 300-meter radius

Table 3.26 Flora in Buffer Zone

S.No	Local Name	Scientific name	Family name	Total No. of species	Total of Quadrants with species	Total No. of Quadrants	Density	Frequency (%)	Abundance	Relative Density	Relative Frequency	IVI	IUCN Conservation Status
TREES													
1	Vembu	*Azadirachta indica*	Meliaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
2	Thekku	*Tectona grandis*	Verbenaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
3	Pongam oiltree	*Pongamia pinnata*	Fabaceae	6	5	10	0.6	50.0	1.2	2.6	2.7	5.2	Not Listed
4	Thennai maram	*Cocos nucifera*	Arecaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
5	Manga	*Mangifera indica*	Anacardiaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
6	Puliyamaram	*Tamarindus indica*	Legumes	3	2	10	0.3	20.0	1.5	1.3	1.1	2.4	Not Listed
7	Vadanarayani	*Delonix elata*	Fabaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
8	Thenpazham	*Muntingia calabura*	Tiliaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
9	Punnai	*Calophyllu inophyllum*	Calophyllaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
10	Athi	*Ficus recemosa*	Moraceae	6	5	10	0.6	50.0	1.2	2.6	2.7	5.2	Not Listed
11	Ilanthai	*Ziziphus jujubha*	Rhamnaceae	7	6	10	0.7	60.0	1.2	3.0	3.2	6.2	Not Listed
12	Karuvelam	*Acacia nilotica*	Mimosaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
13	Kadukkai	*Terminalia chebula*	Combretaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
14	Nettilinkam	*Polylathia longifolia*	Annonaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
15	Perumungil	*Bambusa bamboos'*	Poaceae	6	5	10	0.6	50.0	1.2	2.6	2.7	5.2	Not Listed
16	Arai nelli	*Phyllanthus acidus*	Euphorbiaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
17	Panai maram	*Borassus flabellifer*	Arecaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
18	Sapota	*Manilkara zapota*	Sapotaceae	7	6	10	0.7	60.0	1.2	3.0	3.2	6.2	Not Listed
19	Navalmaram	*Sygygium cumini*	Myrtaceae	6	5	10	0.6	50.0	1.2	2.6	2.7	5.2	Not Listed
20	Ezhumuchaipalam	*Citrus lemon*	Rutaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
21	Alamaram	*Ficus benghalensis*	Moraceae	3	2	10	0.3	20.0	1.5	1.3	1.1	2.4	Not Listed

22	Karivembu	*Murraya koenjii*	Rubiaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
23	Vazhaimaram	*Musa*	Musaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
24	Karuvelam maram	*Vachellia nilotica*	Fabaceae	6	5	10	0.6	50.0	1.2	2.6	2.7	5.2	Not Listed
25	Nelli	*Emblica officinalis*	Phyllanthaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
26	Eucalyptus	*Eucalyptus globules*	Myrtaceae	7	6	10	0.7	60.0	1.2	3.0	3.2	6.2	Not Listed
27	Maramalli	*Millingtonia hortensis*	Bignoniaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
28	Palamaram	*Artocarpus heterophyllus*	Moraceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
29	Kuduka puli	*Pithecellobium dulce*	Mimosaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
30	Karungali	*Acacia sundra*	Legumes	6	5	10	0.6	50.0	1.2	2.6	2.7	5.2	Not Listed
31	Marudaani	*Lawsonia inermis*	Lythraceae	7	6	10	0.7	60.0	1.2	3.0	3.2	6.2	Not Listed
32	Nochi	*Vitex negundo*	Lamiaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
33	Manja kadambai	*Adina cordifolia*	Rubiaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
34	Karimurungai	*Moringa olefera*	Moraginaceae	7	6	10	0.7	60.0	1.2	3.0	3.2	6.2	Not Listed
35	Pappali maram	*Carica papaya L*	Caricaceae	8	7	10	0.8	70.0	1.1	3.4	3.7	7.2	Not Listed
36	Velipparuthi	*Murraya koenigii*	Asclepiadaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
37	Nochi	*Vitex negundo*	Verbenaceae	6	5	10	0.6	50.0	1.2	2.6	2.7	5.2	Not Listed
38	Poovarasu	*Thespesia populnea*	Malvaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
39	Arasanmaram	*Ficus religiosa*	Moraceae	3	2	10	0.3	20.0	1.5	1.3	1.1	2.4	Not Listed
40	Vilvam	*Aegle marmelos*	Rutaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
41	Nuna maram	*Morinda citrifolia*	Rubiaceae	4	3	10	0.4	30.0	1.3	1.7	1.6	3.3	Not Listed
42	Nettilingam	*Polyalthia longifolia*	Annonaceae	6	5	10	0.6	50.0	1.2	2.6	2.7	5.2	Not Listed
43	Koyya	*Psidium guajava*	Myrtaceae	7	6	10	0.7	60.0	1.2	3.0	3.2	6.2	Not Listed
44	Seethapazham	*Annona reticulata*	Annonaceae	8	7	10	0.8	70.0	1.1	3.4	3.7	7.2	Not Listed
45	Moonghil	*Bambusa bambo*	Poaceae	5	4	10	0.5	40.0	1.3	2.1	2.1	4.3	Not Listed
SHRUBS													
46	Avarai	*Senna auriculata*	Fabaceae	8	7	15	0.5	46.7	1.1	5.2	5.3	10.5	Not Listed
47	Sundaika	*Solanum torvum*	Solanaceae	7	6	15	0.5	40.0	1.2	4.5	4.5	9.1	Not Listed
48	Puramuttai	*Chrozophora rottleri*	Euphorbiaceae	6	5	15	0.4	33.3	1.2	3.9	3.8	7.7	Not Listed
49	Arali	*Nerium indicum*	Apocynaceae	8	7	15	0.5	46.7	1.1	5.2	5.3	10.5	Not Listed
50	Seemaiagaththi	*Cassia alata*	Caesalpinaceae	7	6	15	0.5	40.0	1.2	4.5	4.5	9.1	Not Listed
51	Chemparuthi	*Hibiscu rosa-sinensis*	Malvaceae	9	8	15	0.6	53.3	1.1	5.8	6.0	11.9	Not Listed
52	Kattamanakku	*Jatropha curcas*	Euphorbiaceae	6	5	15	0.4	33.3	1.2	3.9	3.8	7.7	Not Listed

53	Naanal	*Arunudo donax*	Poaceae	5	4	15	0.3	26.7	1.3	3.2	3.0	6.3	Not Listed
54	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae	8	7	15	0.5	46.7	1.1	5.2	5.3	10.5	Not Listed
55	Idlipoo	*xoracoc cinea*	Rubiaceae	9	8	15	0.6	53.3	1.1	5.8	6.0	11.9	Not Listed
56	Neivelikattamanaku	*Ipomoea carnea*	Convolvulaceae	6	5	15	0.4	33.3	1.2	3.9	3.8	7.7	Not Listed
57	Thuthi	*Abutilon indicum*	Meliaceae	7	6	15	0.5	40.0	1.2	4.5	4.5	9.1	Not Listed
58	Nithyakalyani	*Cathranthus roseus*	Apocynaceae	8	7	15	0.5	46.7	1.1	5.2	5.3	10.5	Not Listed
59	Icham	*Phoenix pusilla*	Arecaceae	6	5	15	0.4	33.3	1.2	3.9	3.8	7.7	Not Listed
60	Uumaththai	*Datura metel*	Solanaceae	9	8	15	0.6	53.3	1.1	5.8	6.0	11.9	Not Listed
61	Kundumani	*Abrus precatorius*	Fabaceae	7	6	15	0.5	40.0	1.2	4.5	4.5	9.1	Not Listed
62	Erukku	*Calotropis gigantea*	Apocynaceae	8	7	15	0.5	46.7	1.1	5.2	5.3	10.5	Not Listed
63	Sangankuppi	*Clerodendurm inerme*	Verbenaceae	9	8	15	0.6	53.3	1.1	5.8	6.0	11.9	Not Listed
64	Neermulli	*Hydrophila auriculata*	Acanthaceae	6	5	15	0.4	33.3	1.2	3.9	3.8	7.7	Not Listed
65	Thottalchinuni	*Mimosa pudica*	Mimosaceae	7	6	15	0.5	40.0	1.2	4.5	4.5	9.1	Not Listed
66	Kilukiluppai	*Crotalaria retusa*	Fabaceae	8	7	15	0.5	46.7	1.1	5.2	5.3	10.5	Not Listed
HERBS, CLIMBER, CREEPER &GRASSE1S													
67	Nayuruv	*Achyranthes aspera*	Amaranthaceae	6	5	25	0.2	20.0	1.2	1.8	1.7	3.5	Not Listed
68	Veetukaayapoondu	*Tridax procumbens*	Asteraceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
69	Mukkirattai	*Boerhaavia diffusa*	Nyctaginaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
70	Kuppaimeni	*Acalypha indica*	Euphorbiaceae	9	8	25	0.4	32.0	1.1	2.7	2.7	5.4	Not Listed
71	Manjal	*Curcuma longa*	Zingiberaceae	6	5	25	0.2	20.0	1.2	1.8	1.7	3.5	Not Listed
72	Karisilanganni	*Eclipta prostata*	Asteraceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
73	Korai	*Cyperus rotundus*	Cyperaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
74	Kaduku	*Brassica juncea*	Brassaceae	6	5	25	0.2	20.0	1.2	1.8	1.7	3.5	Not Listed
75	Kanamvazha	*Commelina benghalensis*	Commelinaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
76	Thumbai	*Leucas aspera*	Lamiaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
77	Nai kadugu	*Celome viscosa*	Capparidaceae	9	8	25	0.4	32.0	1.1	2.7	2.7	5.4	Not Listed
78	Parttiniyam	*Parthenium hysterophorus*	Asteraceae	6	5	25	0.2	20.0	1.2	1.8	1.7	3.5	Not Listed
79	Mukurattai	*Boerhavia diffusa*	Nyctaginaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
80	Thulasi	*Ocimum tenuiflorum*	Lamiaceae	10	11	25	0.4	44.0	0.9	3.0	3.8	6.8	Not Listed
81	Arugampul	*Cynodon dactylon*	Poaceae	12	11	25	0.5	44.0	1.1	3.6	3.8	7.4	Not Listed
82	Manathakkali	*Solanumnigrum*	Solanaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
83	Kudai korai	*Cyperus difformis*	Cyperaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
84	Thoiya keerai	*Digeria muricata*	Amarantheceae	9	8	25	0.4	32.0	1.1	2.7	2.7	5.4	Not Listed

85	Kovai	*Coccinia grandis*	Cucurbitaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
86	Perandai	*Cissus quadrangularis*	Vitaceae	10	9	25	0.4	36.0	1.1	3.0	3.1	6.1	Not Listed
87	Mudakkotan	*Cardiospermum helicacabum*	Sapindaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
88	Karkakartum	*Clitoria ternatea*	Fabaceae	6	5	25	0.2	20.0	1.2	1.8	1.7	3.5	Not Listed
89	Nannari	*Hemidesmus indicus*	Asclepiadaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
90	Kovakkai	*Trichosanthes dioica*	Cucurbitaceae	9	8	25	0.4	32.0	1.1	2.7	2.7	5.4	Not Listed
91	Sangupoo	*Clitoriaternatia*	Fabaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
92	Malli	*Jasminum augustifolium*	Oleaceae	6	5	25	0.2	20.0	1.2	1.8	1.7	3.5	Not Listed
93	Sorakkai	*Lagenaria siceraria*	Cucurbitaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
94	Siru puladi	*Desmodium triflorum*	Fabaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
95	Sithrapaalavi	*Euphorbia prostrata*	Euphorbiaceae	6	5	25	0.2	20.0	1.2	1.8	1.7	3.5	Not Listed
96	Korai	*Cyperus rotandus*	Poaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
97	Thumattikai	*Cucumis callosus*	Cucurbitaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
98	Seppu nerunjil	*Indigofera enneaphylla*	Fabaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
99	Vallikeerai	*Ipomoea aquatica*	Convolvulaceae	6	5	25	0.2	20.0	1.2	1.8	1.7	3.5	Not Listed
100	Elikkathilai	*Merremia gangetica*	Convolvulaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
101	Muthiyar koontha	*Merremia tridentata*	Convolvulaceae	9	8	25	0.4	32.0	1.1	2.7	2.7	5.4	Not Listed
102	Poduthalai	*Phyla nodifolia*	Verbenaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
103	mookuthi poondu	*Wedelia trilobata*	Asteraceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
104	Kattu kanchippul	*Apluda mutica*	Poaceae	9	8	25	0.4	32.0	1.1	2.7	2.7	5.4	Not Listed
105	Chevvarakupul	*Chloris barbata*	Amaranthaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
106	Kuthirai vaal	*Echinochloa colona*	Poaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed
107	Pullu	*Eragrostis ferruginea*	Poaceae	10	9	25	0.4	36.0	1.1	3.0	3.1	6.1	Not Listed
108	Musthakasu	*Kyllinga brevifolia*	Cyperaceae	7	6	25	0.3	24.0	1.2	2.1	2.1	4.2	Not Listed
109	Nagathali	*Opuntia dillenii*	Cactaceae	8	7	25	0.3	28.0	1.1	2.4	2.4	4.8	Not Listed

Table 3.27 Calculation of Species Diversity in Buffer Zone

S.No	Common name	Scientific name	No. of Species	Pi	In (Pi)	Pi x in (Pi)
Trees						
1	Vembu	*Azadirachta indica*	5	0.02	-3.84	-0.08
2	Thekku	*Tectona grandis*	4	0.02	-4.06	-0.07
3	Pongam oiltree	*Pongamia pinnata*	6	0.03	-3.66	-0.09
4	Thennai maram	*Cocos nucifera*	4	0.02	-4.06	-0.07
5	Manga	*Mangifera indica*	5	0.02	-3.84	-0.08
6	Puliyamaram	*Tamarindus indica*	3	0.01	-4.35	-0.06
7	Vadanarayani	*Delonix elata*	4	0.02	-4.06	-0.07
8	Thenpazham	*Muntingia calabura*	5	0.02	-3.84	-0.08
9	Punnai	*Calophyllu inophyllum*	4	0.02	-4.06	-0.07
10	Athi	*Ficus recemosa*	6	0.03	-3.66	-0.09
11	Ilanthai	*Ziziphus jujubha*	7	0.03	-3.51	-0.11
12	Karuvelam	*Acacia nilotica*	5	0.02	-3.84	-0.08
13	Kadukkai	*Terminalia chebula*	4	0.02	-4.06	-0.07
14	Nettilinkam	*Polylathia longifolia*	5	0.02	-3.84	-0.08
15	Perumungil	*Bambusa bamboos'*	6	0.03	-3.66	-0.09
16	Arai nelli	*Phyllanthus acidus*	5	0.02	-3.84	-0.08
17	Panai maram	*Borassus flabellifer*	4	0.02	-4.06	-0.07
18	Sapota	*Manilkara zapota*	7	0.03	-3.51	-0.11
19	Navalmaram	*Sygygium cumini*	6	0.03	-3.66	-0.09
20	Ezhumuchaipalam	*Citrus lemon*	5	0.02	-3.84	-0.08
21	Alamaram	*Ficus benghalensis*	3	0.01	-4.35	-0.06
22	Karivembu	*Murraya koenjii*	4	0.02	-4.06	-0.07
23	Vazhaimaram	*Musa*	5	0.02	-3.84	-0.08
24	Karuvelam maram	*Vachellia nilotica*	6	0.03	-3.66	-0.09
25	Nelli	*Emblica officinalis*	4	0.02	-4.06	-0.07
26	Eucalyptus	*Eucalyptus globules*	7	0.03	-3.51	-0.11
27	Maramalli	*Millingtonia hortensis*	5	0.02	-3.84	-0.08
28	Palamaram	*Artocarpus heterophyllus*	4	0.02	-4.06	-0.07
29	Kuduka puli	*Pithecellobium dulce*	5	0.02	-3.84	-0.08
30	Karungali	*Acacia sundra*	6	0.03	-3.66	-0.09
31	Marudaani	*Lawsonia inermis*	7	0.03	-3.51	-0.11
32	Nochi	*Vitex negundo*	5	0.02	-3.84	-0.08
33	Manja kadambai	*Adina cordifolia*	4	0.02	-4.06	-0.07
34	Karimurungai	*Moringa olefera*	7	0.03	-3.51	-0.11
35	Pappali maram	*Carica papaya L*	8	0.03	-3.37	-0.12
36	Velipparuthi	*Murraya koenigii*	5	0.02	-3.84	-0.08
37	Nochi	*Vitex negundo*	6	0.03	-3.66	-0.09
38	Poovarasu	*Thespesia populnea*	4	0.02	-4.06	-0.07
39	Arasanmaram	*Ficus religiosa*	3	0.01	-4.35	-0.06
40	Vilvam	*Aegle marmelos*	5	0.02	-3.84	-0.08
41	Nuna maram	*Morinda citrifolia*	4	0.02	-4.06	-0.07
42	Nettilingam	*Polyalthia longifolia*	6	0.03	-3.66	-0.09

43	Koyya	*Psidium guajava*	7	0.03	-3.51	-0.11
44	Seethapazham	*Annona reticulata*	8	0.03	-3.37	-0.12
45	Moonghil	*Bambusa bambo*	5	0.02	-3.84	-0.08
H (Shannon Diversity Index) =3.78						
SHRUBS						
46	Avarai	*Senna auriculata*	8	0.05	-2.96	-0.15
47	Sundaika	*Solanum torvum*	7	0.05	-3.09	-0.14
48	Puramuttai	*Chrozophora rottleri*	6	0.04	-3.25	-0.13
49	Arali	*Nerium indicum*	8	0.05	-2.96	-0.15
50	Seemaiagaththi	*Cassia alata*	7	0.05	-3.09	-0.14
51	Chemparuthi	*Hibiscu rosa-sinensis*	9	0.06	-2.84	-0.17
52	Kattamanakku	*Jatropha curcas*	6	0.04	-3.25	-0.13
53	Naanal	*Arunudo donax*	5	0.03	-3.43	-0.11
54	Chaturakalli	*Euphorbia antiquorum*	8	0.05	-2.96	-0.15
55	Idlipoo	*xoracoc cinea*	9	0.06	-2.84	-0.17
56	Neivelikattamanaku	*Ipomoea carnea*	6	0.04	-3.25	-0.13
57	Thuthi	*Abutilon indicum*	7	0.05	-3.09	-0.14
58	Nithyakalyani	*Cathranthus roseus*	8	0.05	-2.96	-0.15
59	Icham	*Phoenix pusilla*	6	0.04	-3.25	-0.13
60	Uumaththai	*Datura metel*	9	0.06	-2.84	-0.17
61	Kundumani	*Abrus precatorius*	7	0.05	-3.09	-0.14
62	Erukku	*Calotropis gigantea*	8	0.05	-2.96	-0.15
63	Sangankuppi	*Clerodendurm inerme*	9	0.06	-2.84	-0.17
64	Neermulli	*Hydrophila auriculata*	6	0.04	-3.25	-0.13
65	Thottalchinuni	*Mimosa pudica*	7	0.05	-3.09	-0.14
66	Kilukiluppai	*Crotalaria retusa*	8	0.05	-2.96	-0.15
H (Shannon Diversity Index) =3.03						
HERBS & CLIMBER &CREEPER & GRASS & CATUS						
67	Nayuruv	*Achyranthes aspera*	6	0.02	-4.02	-0.07
68	Veetukaayapoondu	*Tridax procumbens*	7	0.02	-3.86	-0.08
69	Mukkirattai	*Boerhaavia diffusa*	8	0.02	-3.73	-0.09
70	Kuppaimeni	*Acalypha indica*	9	0.03	-3.61	-0.10
71	Manjal	*Curcuma longa*	6	0.02	-4.02	-0.07
72	Karisilanganni	*Eclipta prostata*	8	0.02	-3.73	-0.09
73	Korai	*Cyperus rotundus*	7	0.02	-3.86	-0.08
74	Kaduku	*Brassica juncea*	6	0.02	-4.02	-0.07
75	Kanamvazha	*Commelina benghalensis*	7	0.02	-3.86	-0.08
76	Thumbai	*Leucas aspera*	8	0.02	-3.73	-0.09
77	Nai kadugu	*Celome viscosa*	9	0.03	-3.61	-0.10
78	Parttiniyam	*Parthenium hysterophorus*	6	0.02	-4.02	-0.07
79	Mukurattai	*Boerhavia diffusa*	7	0.02	-3.86	-0.08
80	Thulasi	*Ocimum tenuiflorum*	10	0.03	-3.51	-0.11
81	Arugampul	*Cynodon dactylon*	12	0.04	-3.32	-0.12
82	Manathakkali	*Solanumnigrum*	7	0.02	-3.86	-0.08
83	Kudai korai	*Cyperus difformis*	8	0.02	-3.73	-0.09
84	Thoiya keerai	*Digeria muricata*	9	0.03	-3.61	-0.10

85	Kovai	*Coccinia grandis*	8	0.02	-3.73	-0.09
86	Perandai	*Cissus quadrangularis*	10	0.03	-3.51	-0.11
87	Mudakkotan	*Cardiospermum helicacabum*	7	0.02	-3.86	-0.08
88	Karkakartum	*Clitoria ternatea*	6	0.02	-4.02	-0.07
89	Nannari	*Hemidesmus indicus*	8	0.02	-3.73	-0.09
90	Kovakkai	*Trichosanthes dioica*	9	0.03	-3.61	-0.10
91	Sangupoo	*Clitoriaternatia*	8	0.02	-3.73	-0.09
92	Malli	*Jasminum augustifolium*	6	0.02	-4.02	-0.07
93	Sorakkai	*Lagenaria siceraria*	7	0.02	-3.86	-0.08
94	Siru puladi	*Desmodium triflorum*	8	0.02	-3.73	-0.09
95	Sithrapaalavi	*Euphorbia prostrata*	6	0.02	-4.02	-0.07
96	Korai	*Cyperus rotandus*	8	0.02	-3.73	-0.09
97	Thumattikai	*Cucumis callosus*	7	0.02	-3.86	-0.08
98	Seppu nerunjil	*Indigofera enneaphylla*	8	0.02	-3.73	-0.09
99	Vallikeerai	*Ipomoea aquatica*	6	0.02	-4.02	-0.07
100	Elikkathilai	*Merremia gangetica*	8	0.02	-3.73	-0.09
101	Muthiyar koontha	*Merremia tridentata*	9	0.03	-3.61	-0.10
102	Poduthalai	*Phyla nodifolia*	7	0.02	-3.86	-0.08
103	mookuthi poondu	*Wedelia trilobata*	8	0.02	-3.73	-0.09
104	Kattu kanchippul	*Apluda mutica*	9	0.03	-3.61	-0.10
105	Chevvarakupul	*Chloris barbata*	7	0.02	-3.86	-0.08
106	Kuthirai vaal	*Echinochloa colona*	8	0.02	-3.73	-0.09
107	Pullu	*Eragrostis ferruginea*	10	0.03	-3.51	-0.11
108	Musthakasu	*Kyllinga brevifolia*	7	0.02	-3.86	-0.08
109	Nagathali	*Opuntia dillenii*	8	0.02	-3.73	-0.09
H (Shannon Diversity Index) =3.75						

Table 3.28 Species Richness (Index) in Buffer Zone

Details	H	H max	Evenness	Species Richness
Tree	3.78	3.81	0.99	8.07
Shrubs	3.03	3.04	1.00	3.97
Herbs	3.75	3.76	1.00	7.23

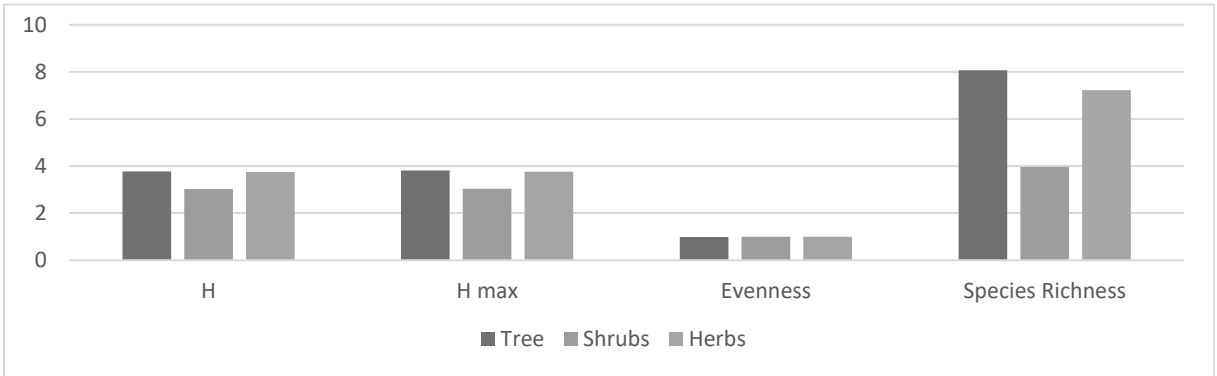
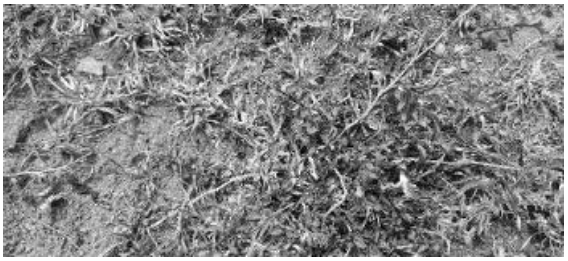


Figure 3.27 Floral diversity species Richness (Index) in buffer zone



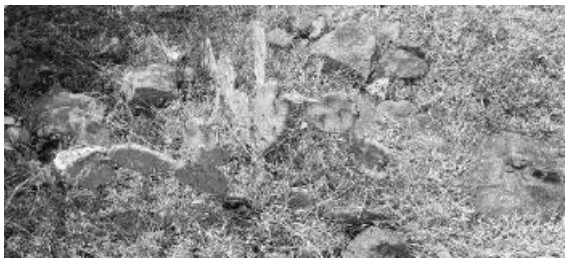
Echiochilon fruticosum Desf

Tribulus cistoides L

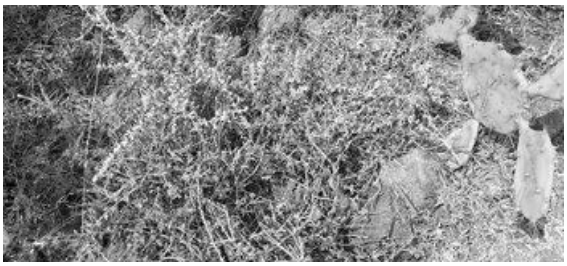
Leucas lavandulifolia

Tephrosia purpurea (L.)

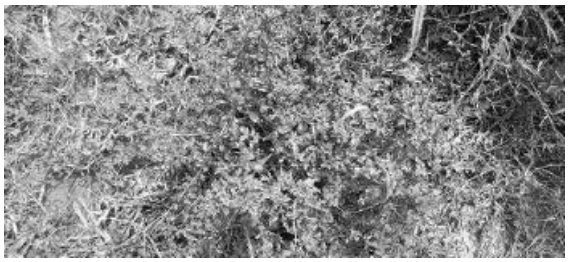
Paspalum quadrifarium



Opuntia engelmannii Salm



Aerva lanata



Catunaregam spinosalc

Morinda tinctoria

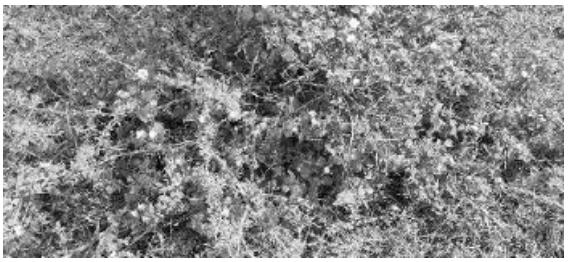
Euphorbia cooperi

Acacia karroo Hayne

Cissus quadrangularis

Lantana camara L

Senna auriculata



Lantana velutina

Jatropha gossypiifolia

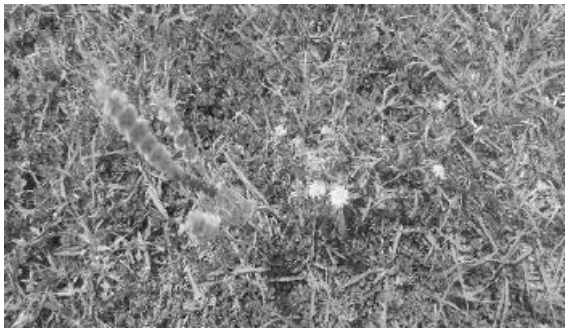
Cassia roxburghii

Chloris verticillata

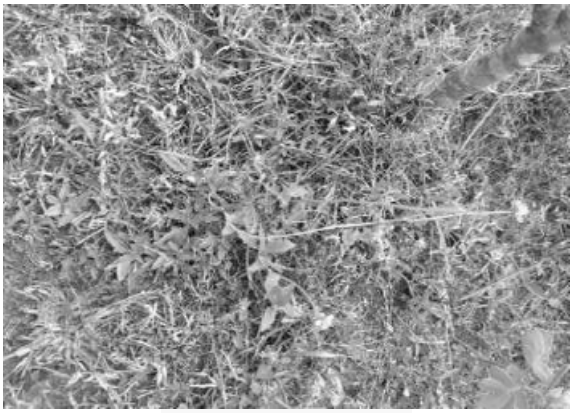
Tectona grandis

Calotropis Gigantea

Hyptis suaveolens



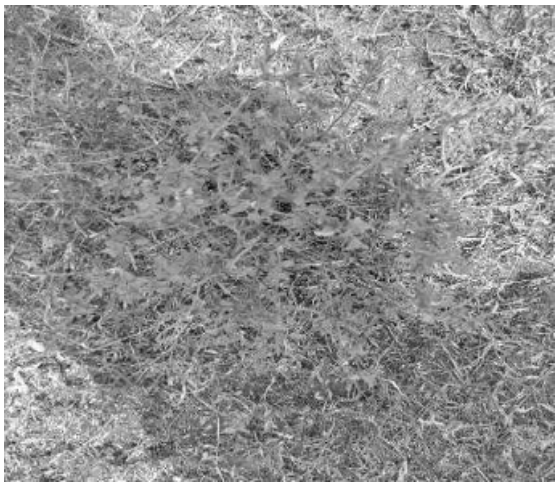
Senecio madagascariensis Poir



Tridax procumbens

Senna sophera

Prosopis juliflora



Ocimum tenuiflorum

Albizia amara

Typha x glauca

Dodonaea viscosa

Azadirachta indica

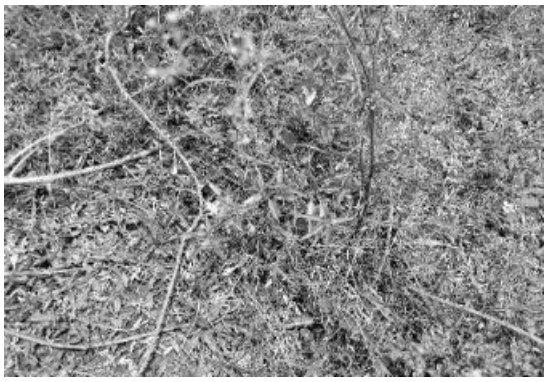
Catunaregam spinosa

Cuscuta

Vitex negundo

Ipomoea carnea

Wrightia tinctoria



Croton bonplandianus

Figure 3.28 Flora in Core and Buffer Area

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 3.29.

Table 3.29 Aquatic Vegetation

S.No.	Scientific name	Common Name	IUCN Red List Status
1	*Eichornia crassipes*	Water hyacinth	NA
2	*Aponogetonnatans*	Floating lace plant	NA
3	*Carex cruciata*	Cross Grass	NA
4	*Cynodon dactylon*	Scutch grass	LC

*LC- Least Concern, NA-Not yet assessed

Forest Vegetation

There are no biosphere reserves or wildlife sanctuaries or National parks or Important Bird Areas (IBAs), or migratory routes of fauna. Waguthumalai R. F. located on 0.63 m Eastern side, Sirumalai R., F 4.42 km NW, Kulasekarankottai R.F 5.58 km NW Sembatti R. F 7.49 km NE, Viralipatti R.F 5.16 km E, of the lease area. The area under study (Mine lease area and the 10 km buffer zone) is not ecologically sensitive. Forest Vegetation Details Mention in Table 3.30

Table No.3.30 Vegetation details in the Reserve Forest area

S.NO	Scientific name	Family Name
1	*Ailanthus excelsa*	Simaroubaceae
2	*Tamarindus indica*	Fabaceae
3	*Leucaena leucocephala*	Fabaceae
4	*Albizia lebbeck*	Fabaceae
5	*Albizia amara,*	Fabaceae
6	*Azadirachta indica*	Meliaceae
7	*Tectonia grandis*	Lamiaceae
8	*Peltophorum pterocarpum*	Fabaceae
9	*Terminalia Arjuna*	Combretaceae
10	*Ziziphusmauritiana*	Rhamnaceae
11	*Bambusaarundinacea*	Poaceae
12	*Dalbergialanceolaria*	Fabaceae
13	*Wrightiatinctoria*	Apocynaceae
14	*Syzygiumcumin*	Myrtaceae
15	*Hardwickiabinata*	Fabaceae
16	*Lanneacoromandelica*	Anacardiaceae
17	*Diospyros melanoxylon*	Ebenaceae
18	*Tremaorientalis*	Cannabaceae
19	*Anogeissuslatifolia*	Combretaceae
20	*Ficusbenghalensis*	Moraceae
21	*Dalbergia sissoo*	Fabaceae
22	*Melia azedarac2wh*	Meliaceae
23	*Albiziaodoratissima*	Fabaceae
24	*Acacia catechu*	Fabaceae
25	*Prosopis juliflora*	Fabaceae

Endangered and endemic species as per the IUCN Red List

There are no rare, endangered and endemic species found in the study area. There are no biosphere reserves or wildlife sanctuaries or National parks or Important Bird Areas (IBAs), ecologically sensitive zone.

3.5.2 Fauna

The faunal survey was carried out for Mammals, Birds, Reptiles, Amphibians and Butterflies. There are no rare, endangered, threatened (RET) and endemic species present in core area.

Fauna Methodology

Table 3.31 Methodology Applied during 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)

Fauna in Core Zone

A total of 24 varieties of species observed in the Core zone of Katchaikatti village, rough stone and gravel quarry (Table No.3.7) among them numbers of Insects 7 (29%), Reptiles 5 (21%), Mammals 3 (13%) and Avian 9 (37%). A total of 24 species belonging to 19 families have been recorded from the core mining lease area. There are one schedule II species and 8 species are under schedule IV according to Indian wild life Act 1972. A total of 9 species of bird were sighted in the study area. Details of fauna in core zone with the scientific name were mentioned in Table. 3.32.

Fauna in Buffer Zone

Taxonomically a total of 53 species belonging to 37 families have been recorded from the buffer zone area. Based on habitat classification the majority of species were Birds 22 (41%), followed by insects 13 (24%), reptiles 12 (23%), mammals 3 (6%) and amphibians 3 (6%). There are six schedule II species and thirty species are under schedule IV according to Indian wild life Act 1972. A total of 22 species of bird were sighted in the study area. There are no critically endangered, endangered, vulnerable and endemic species were observed. Details of fauna in buffer zone with the scientific name were mentioned in Table. 3.33.

Table 3.32 Fauna in Core Zone

S.No	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
Insects					
1	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC
2	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
3	Mottled emigrant	Peridae	*Catopsilia pyranthe*	NL	LC
4	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
5	Stick insect	Lonchodidae	*carausius morosus*	NL	LC
6	Praying mantis	Mantidae	*Mantis religiosa*	NL	NL
7	Common Tiger	Nymphalidae	*Danaus genutia*	NL	NL
Reptiles					
8	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
9	Fan-Throated Lizard	Agamidae	*Sitanaponticeriana*	NL	LC
10	Common skink	Scincidae	*Mabuya carinatus*	NL	LC
11	Brahminy skink	Scincidae	*Eutropis carinata*	NL	LC
12	Common house gecko	Gekkonidae	*Hemidactylus frenatus*	NL	LC
Mammals					
13	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	NL
14	Common rat	Muridae	*Rattus rattus*	Schedule IV	LC
15	Asian Small Mongoose	Herpestidae	*Herpestes javanicus*	Schedule (Part II)	LC
Aves					
16	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
17	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
18	Rose-ringed parkeet	Psittaculidae	*Psittacula krameri*	NL	
19	Two-tailed Sparrow	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
20	Cattle egret	Ardeidae	*Bubulcus ibis*	NL	LC
21	Black drongo	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
22	House crow	Corvidae	*Corvussplendens*	NL	LC
23	Red-vented Bulbul	Pycnonotidae	*Pycnonotuscafer*	Schedule IV	LC
24	Common quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC

*NE- Not Evaluated; LC- Least Concern, NT –Near Threatened, T-Threatened

Table 3.33 Fauna in Buffer Zone

S. No.	Common Name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
Insects					
1	Indian honey bee	Apidae	*Apis cerana*	Schedule IV	LC
2	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
3	Tawny coster	Nymphalidae	*Danaus chrysippus*	Schedule IV	LC
4	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
5	Jewel beetle	Buprestidae	*Eurythyrea austriaca*	Schedule IV	NA
6	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC
7	Ant	Formicidae	*Camponotus Vicinus*	NL	NL
8	Common Tiger	Nymphalidae	*Danaus genutia*	Schedule IV	LC
9	Dragonfly	Gomphidae	*Ceratogomphus pictus*	Schedule IV	LC
10	Milkweed butterfly	Nymphalidae	*Danainae*	NL	LC
11	Common Indian crow	Nymphalidae	*Euploea core*	Schedule IV	LC
12	Lesser grass blue	Lycaenidae	*Zizina Otis indica*	Schedule IV	LC
13	Blue tiger	Nymphalidae	*Tirumala limniace*	Schedule IV	LC
Reptiles					
14	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
15	Chameleon	Chamaeleonidae	*Chameleon zeylanicus*	Schedule IV	LC
16	Fan-Throated Lizard	Agamidae	*Sitanaponticeriana*	NL	LC
17	Indian wall lizard	Gekkonidae	*Hemidactylus flaviviridis*	Schedule IV	NL
18	Rat snake	Colubridae	*Ptyas mucosa*	Sch II (Part II)	LC
19	Olive keelback water snake	Natricidae	*Atretium schistosum*	Sch II (Part II)	LC
20	Whip Snake	Elapidae	*Dryphis nasutus*	Sch II (Part II)	LC
21	Brahminy skink	Scincidae	*Eutropis carinata*	NL	LC
22	Russell's viper	Viperidae	*Vipera russseli*	Sch II (Part II)	LC
23	Saw scaled viper	Elapidae	*Echis carinatus*	Sch II (Part II)	LC
24	Common house gecko	Gekkonidae	*Hemidactylus frenatus*	NL	LC
25	Common skink	Scincidae	*Mabuya carinatus*	NL	LC
Mammals					
26	Indian palm squirrel	Sciuridae	*Funambulus palmarum*	Schedule IV	LC

27	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	LC
28	Asian Small Mongoose	Herpestidae	*Herpestes javanicus*	Schedule (Part II)	LC
Aves					
29	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
30	Cattle egret	Ardeidae	*Bubulcus ibis*	NL	LC
31	Blue Rock Pigeon	Columbidae	*Columba livia*	Schedule IV	LC
32	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
33	House crow	Corvidae	*Corvussplendens*	NL	LC
34	Eurasian coot	Rallidae	*Fulica atra*	Schedule IV	LC
35	Asian green bee-eater	Meropidae	*Meropsorientalis*	NL	LC
36	Red-vented Bulbul	Pycnonotidae	*Pycnonotuscafer*	Schedule IV	LC
37	Small blue Kingfisher	Alcedinidae	*Alcedo atthis*	Schedule IV	LC
38	Rose-ringed parkeet	Psittaculidae	*Psittacula krameri*	NL	LC
39	Shikra	Accipitridae	*Accipiter badius*	NL	LC
40	Common quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
41	Small Sunbird	Nectariniidae	*Nectarinia asiatica*	Schedule IV	LC
42	Black drongo	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
43	Two-tailed Sparrow	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
44	Grey Francolin	Phasianidae	*Francolinus pondicerianus*	Schedule IV	LC
45	Common Quail	Phasianidae	*Coturnix coturnix*	Schedule IV	LC
46	White-breasted waterhen	Rallidae	*Amaurornis phoenicurus*	NL	LC
47	Common Coot	Rallidae	*Fulica atra*	Schedule IV	LC
48	Grey Heron	Ardeidae	*Ardea Cinerea*	Schedule IV	LC
49	Indian pond heron	Ardeidae	*Ardeola grayii*	Schedule IV	LC
50	Little Green Heron	Ardeidae	*Butorides Striatus*	NL	LC
Amphibians					
51	Indian Burrowing frog	Dicroglossidae	*Sphaerotheca breviceps*	Schedule IV	LC
52	Green Pond Frog	Ranidae	*Rana hexadactyla*	Schedule IV	LC
53	Tiger Frog	Chordata	*Hoplobatrachus tigerinus (Rana tigerina)*	Schedule IV	LC

*NL-Not listed, LC-Least concern, NT-Near threatened.

Results

Biological assessment of the site was done to identify ecologically sensitive areas and whether there are any rare, endangered, endemic or threatened (REET) species of flora & fauna in the core area as well its buffer zone to be impacted. The study has also been designed to suggest suitable mitigation measures, if necessary, for protection of wildlife habitats and conservation of REET species if any. The study found that there is no endemic, endangered migratory fauna found in the area. This area is not also a migratory path of any faunal species. Hence, this small mining operation over short period of time will not have any significant impact on the surrounding flora and fauna.

3.6 SOCIO ECONOMICS ENVIRONMENT

An essential part of environmental study is socio-economic environment incorporating various facts related to socio-economic conditions in the area, which deals with the total environment. Socio economic study 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 of aesthetic significance such as temples, historical monuments etc. at the baseline level. This would help in visualizing and predicting the possible impact depending upon the nature and magnitude of the project. Socio-economic study of an area provides a good opportunity to assess the socio-economic condition and possibly makes a change in living and social standards of the particular area benefitted due to the project.

3.6.1 Objectives of the Study

The main objectives of the study are as follows:

- To know the current socio-economic condition in the region to cover the sub sectors education, health, sanitation, and water & food security.
- To recommend practical strategic interventions in the sector.
- To help in providing better living standards.
- To understand skill sets and plan for employment opportunities which shall be created.

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 Socio-Economic Status of Study area

The study area covers 15 villages including Andipatti, Chinnamanayakkanpatti, Kalvelipatti, Katchiakatti, Kattakulam, Kilakarai, Kondayampatti, Kuthimeikipatti, Periya Ilandaikulam, Sambakulam, Thanichiyam, Thethoor, Thummachchampatt, Viralipatti,. As Katchaikatti is the village in which the proposed project site is located, the summary of population facts for the village is exclusively provided in Table 3.34 and for other 16 villages in Tables 3.35-3.37.

Table 3.34 Katchaikatti Village Population Facts

Katchaikatti Village	
Number of Households	3350
Population	13141
Male Population	6552
Female Population	6589
Children Population	1319
Sex-ratio	1006
Literacy	8223
Male Literacy	4591
Female Literacy	3632
Scheduled Tribes (ST) %	5165
Scheduled Caste (SC) %	24
Total Workers	7387
Main Worker	7144
Marginal Worker	243

Table 3.35 Population and Literacy Data of Study Area

´	No of Households	Total Population Person	Total Population Male	Total Population Female	Literates Population Person	Literates Population Male	Literates Population Female	Illiterate Persons	Illiterate Male	Illiterate Female
Andipatti	451	1677	860	817	1233	685	548	444	175	269
Chinnamanayakkanpatti	144	532	263	269	347	183	164	185	80	105
Kalvelipatti	1233	4363	2153	2210	3005	1640	1365	1358	513	845
Katchiakatti	3350	13141	6552	6589	8223	4591	3632	4918	1961	2957
Kattakulam	643	2440	1197	1243	1714	922	792	726	275	451
Kilakarai	133	469	231	238	317	176	141	152	55	97
Kondayampatti	839	2999	1497	1502	2105	1149	956	894	348	546
Kuthimeikipatti	326	1302	630	672	923	496	427	379	134	245
Periya Ilandaikulam	398	1436	747	689	893	516	377	543	231	312
Sambakulam	33	128	64	64	102	53	49	26	11	15
Thanichiyam	1988	7573	3738	3835	5334	2882	2452	2239	856	1383
Thethoor	1538	5906	2996	2910	3804	2155	1649	2102	841	1261
Thummachchampatti	253	947	461	486	634	336	298	313	125	188
Viralipatti	294	1133	581	552	678	386	292	455	195	260
Kulasekarankottai Vadipatti (TP)	6788	26830	13326	13504	19355	10366	8989	7475	2960	4515

Table 3.36 Details on Educational Facilities, Water, and Drainage & Health Facilities

Village	Private Primary School (Numbers)	Govt Vocational Training School/ITI (Numbers)	Primary Health Centre (Numbers)	Tap Water Untreated	River/Canal	Is the Area Covered under Total Sanitation Campaign (TSC)?	Telephone (landlines)	Public Bus Service	Gravel (kutcha) Roads	Commercial Bank	Agricultural Credit Societies	Self - Help Group (SHG)	Nutritional Centres-Anganwadi Centre	Community Centre with/without TV	Power Supply for Domestic Use
Andipatti	0	0	0	1	2	2	1	1	1	1	2	1	1	1	1
Chinnamanayakkanpatti	0	0	0	1	2	2	2	2	1	2	2	2	1	2	1
Kalvelipatti	0	0	0	1	2	1	1	1	1	2	1	1	1	1	1
Katchiakatti	1	0	1	1	1	1	1	1	1	2	1	1	1	1	1
Kattakulam	0	0	0	1	2	2	1	2	1	2	2	1	1	1	1
Kilakarai	0	0	0	1	2	2	2	1	1	2	2	1	1	2	1
Kondayampatti	1	0	0	1	2	1	1	1	1	2	1	1	1	1	1
Kuthimeikipatti	0	0	0	1	2	1	1	1	1	2	2	1	1	1	1
Periya Ilandaikulam	0	0	0	1	2	2	1	1	1	2	2	1	1	1	1
Sambakulam	0	0	0	1	2	1	2	1	1	2	2	1	1	2	1
Thanichiyam	1	0	1	1	2	1	1	1	1	1	1	1	1	1	1
Thethoor	0	0	0	1	2	2	1	1	1	2	2	1	1	1	1
Thummachchampatti	0	0	0	1	2	2	1	1	1	1	2	1	2	2	1
Vaguthumalai															
Viralipatti	0	0	0	1	1	2	1	2	1	2	2	1	1	1	1

Table 3.37 Workers' Profile of Study Area

Village	Total Worker Population Person	Total Worker Population Male	Total Worker Population Female	Main Working Population Person	Main Working Population Male	Main Working Population Female	Main Cultivator Population Person	Main Agricultural Labourers Population Person	Main Other Workers Population Person	Non-Working Population Person
Andipatti	1024	542	482	421	247	174	5	264	151	653
Chinnamanayakkanpatti	252	152	100	239	145	94	2	138	92	280
Kalvelipatti	2324	1350	974	1782	1095	687	128	1121	518	2039
Katchiakatti	7387	4066	3321	7144	3951	3193	438	4558	2032	5754
Kattakulam	1296	733	563	906	553	353	65	551	268	1144
Kilakarai	307	158	149	296	153	143	11	254	29	162
Kondayampatti	1485	910	575	1138	747	391	109	535	475	1514
Kuthimeikipatti	762	408	354	715	392	323	71	494	141	540
Periya Ilandaikulam	874	467	407	622	345	277	144	337	140	562
Sambakulam	74	42	32	44	31	13	3	5	36	54
Thanichiyam	3636	2289	1347	3294	2131	1163	235	1614	1362	3937
Thethoor	3289	1831	1458	3038	1714	1324	438	2124	440	2617
Thummachchampatti	598	310	288	590	306	284	77	289	214	349
Viralipatti	582	325	257	549	314	235	65	378	104	551
Kulasekarankottai, Vadipatti (TP)	12187	7831	4356	8774	5962	2812	803	527	276	14643

3.6.4 Recommendation and Suggestion

- Awareness program should be conducted to make the population aware of education and to get a better livelihood.
- Vocational training programme should 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 should be generated.
- Health care centre and ambulance facility should be provided to the population to get easy access to medical facilities. 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.

3.6.5 Summary & Conclusion

The socio-economic study in the study area 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 a 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.

3.7 TRAFFIC DENSITY

The traffic survey conducted based on the transportation route of material, the Rough Stone and gravel is proposed to be transported mainly through Village Road and Dindigul to Madurai (NH-44) as shown in Table 3.38 and in Figure 3.29. Traffic density measurements 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. Direction for counting the traffic. At the end of each hour, fresh counting and recording was undertaken.

Table 3.38 Traffic Survey Locations

Station Code	Road Name	Distance and Direction	Type of Road
TS1	Village Road	1.14 Km-NW	Village Road
TS2	Dindigul to Madurai (NH-44)	3.77 Km-SW	Dindigul to Madurai (NH-44)

Source: On-site monitoring by GTMS FAE & TM

Table 3.39 Existing Traffic Volume

Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	82	246	48	48	78	39	333
TS2	109	327	63	63	93	46	436

Source: On-site monitoring by GTMS FAE & TM

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

Table 3.40 Rough Stone Transportation Requirement

Transportation of Rough and Gravel per day		
Capacity of trucks	No. of Trips per day	Volume in PCU
15 tonnes	27	81

Source: Approved Mining Plan

Table 3.41 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
Village Road	333	81	414	1200
Dindigul to Madurai (NH-44)	436	81	517	1200

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

- Due to these projects the existing traffic volume will not exceed the traffic limit. As per the IRC 1960 this existing village road can handle 1,200 PCU in hour and Major district road can handle 1500 PCU in hour. Hence there will not be any conjunction due to this proposed transportation.

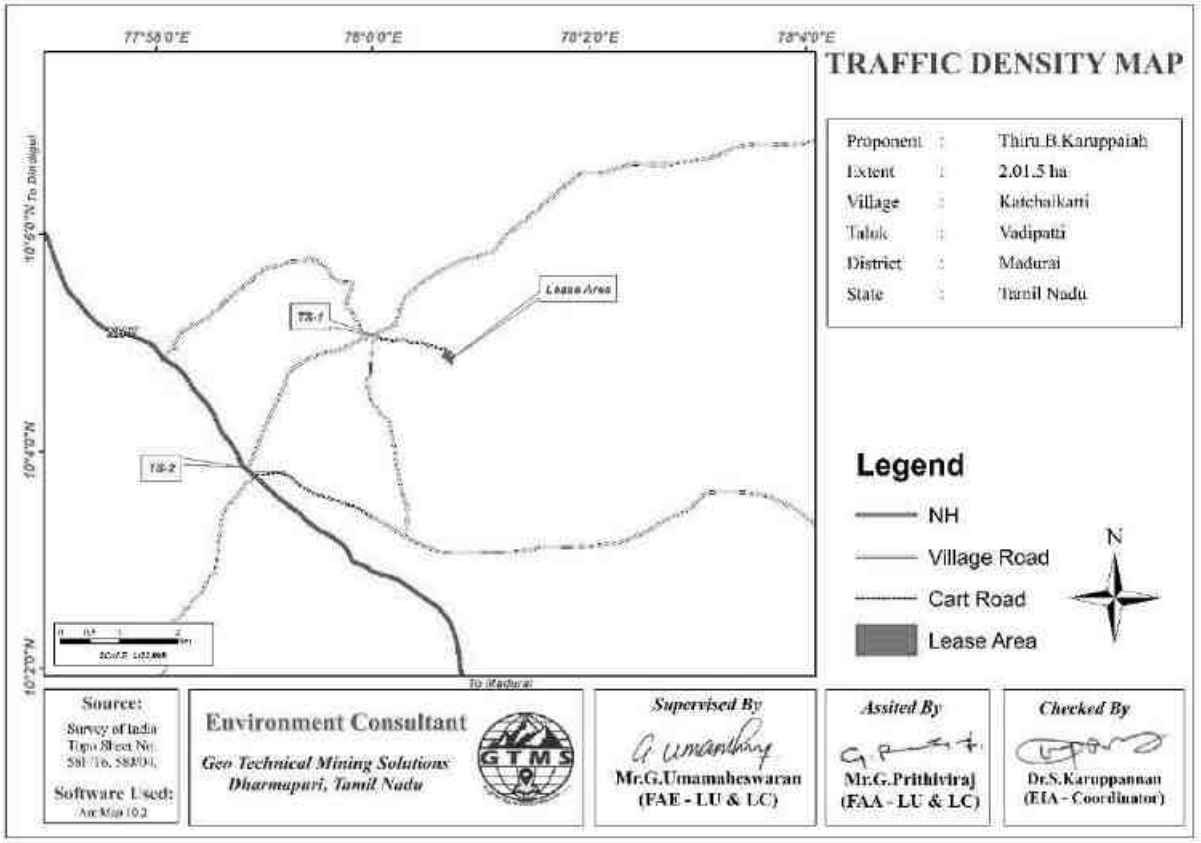


Figure 3.29 Traffic Density Map

3.8 SITE SPECIFIC FEATURES

There are no Wildlife Sanctuaries, Reserve Forest and National Park within 10 km radius. Therefore, there will be no need of acquisition/diversion of forest land. The details related to the environmentally sensitive areas around the proposed mine lease area i.e., 10 km radius and the nearby water bodies are given in the Table 3.42.

Table 3.42 Details of Environmentally Sensitive Ecological Features in the Study Area

S. No.	ensitive Ecological Features	Name	Areal Distance in km
1	National Park / Wild life Sanctuaries	None	Nil within 25 km radius
		None	Nil within 25 km radius
2	Reserve Forest	Waguthumalai	0.63 km E
		Sirumalai	4.42 km NW
		Kulasekarankottai	5.58 km NW
		Sembatti	7.49 km NE
		Mettupatti	15.67 km SW

		Vikramangalam	15.89 km SW
		Mannadimangalam	12.59 km SW
		Uthappanaichanur II	19.39 km SW
		Kiluvamalai	13.48 km E
		Alagarmalai	18.19 km E
		Perumalai	15.96 km NE
		Chempulimalai	24.86 km NE
		Kodimangalam A Blk	12.03 km SE
		Kodimangalam B Blk	13.17 km SE
		Kadavakurichi	20.20 km E
		Viralipatti	5.16 km E
3	Lakes/Reservoirs/ Dams/Streams/Rivers	Vaigai River	10.72 km S
		Sathiar Dam	8.19 km E
		Thathappanakkanpatty Kanmai	3.21 km E
4	Tiger Reserve/Elephant Reserve/ Biosphere Reserve	None	Nil within 10 km radius
5	Critically Polluted Areas	None	Nil within 10 km radius
6	Mangroves	None	Nil within 10 km radius
7	Mountains/Hills	None	Nil within 10 km radius
8	Centrally Protected Archaeological Sites	None	Nil within 10 km radius
9	Industries/ Thermal Power Plants	None	Nil within 10 km radius
10	Defence Installation	None	Nil within 10 km radius

Source: Survey of India Toposheet

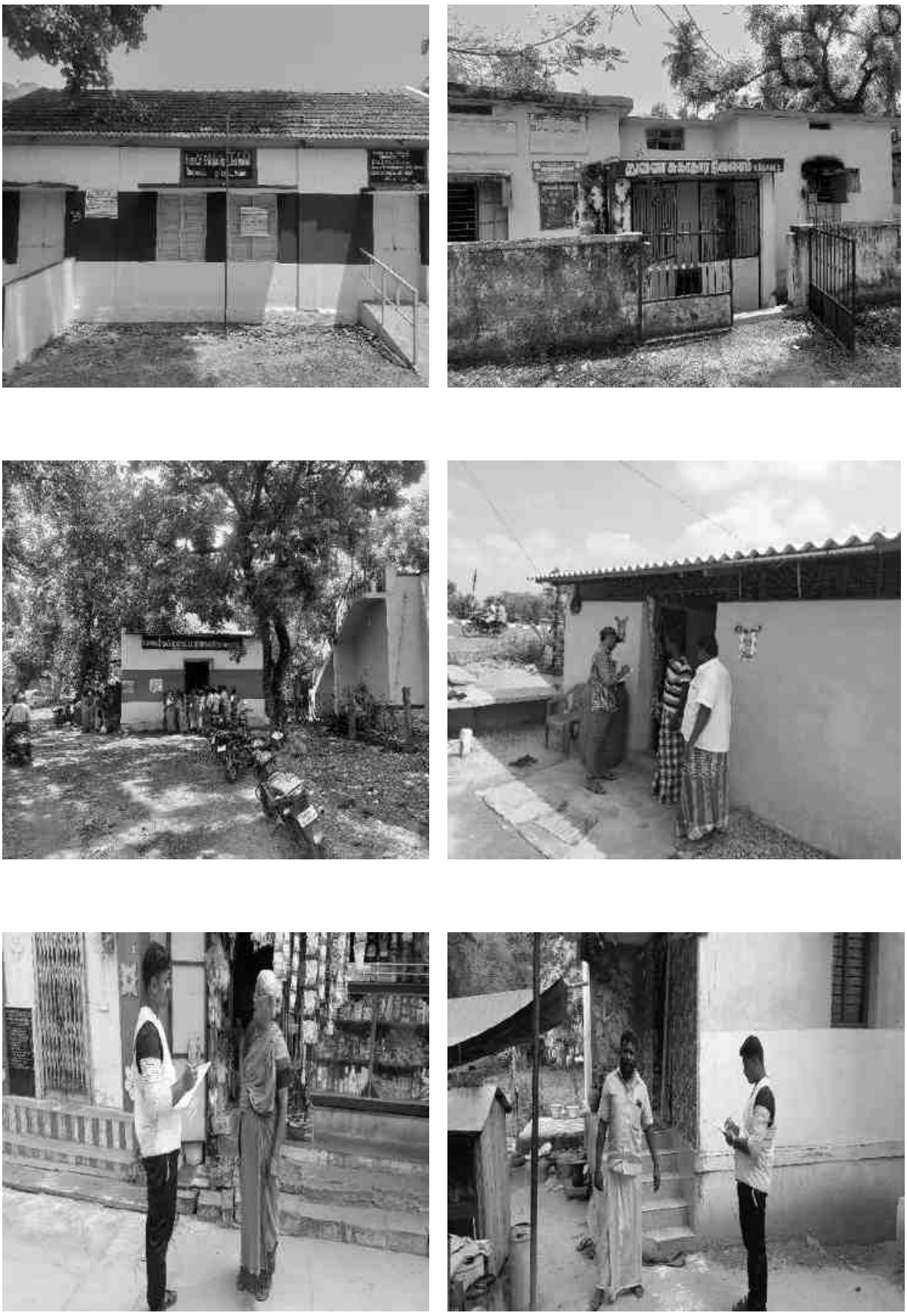


Figure 3.30 Field Study Photographs

CHAPTER IV

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 are identified, quantified and assessed.

4.1 LAND ENVIRONMENT

4.1.1 Anticipated Impact

- Permanent or temporary change on land use and land cover.
- Change in topography of the mine lease area will change at the end of the life of the mine.

- ❖ Problems to agricultural land and human habitations due to dust, and noise caused by movement of heavy vehicles
- ❖ Degradation of the aesthetic environment of the core zone due to quarrying
- ❖ Soil erosion and sediment deposition in the nearby water bodies due to earthworks during the rainy season
- ❖ Siltation of water course due to wash off from the exposed working area

4.1.2 Common Mitigation Measures from Proposed Project

- ❖ The mining activity will be gradual confined in blocks and excavation will be undertaken progressively along with other mitigate 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 minimize 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.

4.2 SOIL ENVIRONMENT

No top soil will be removed in this project. However, some of the common mitigation measures is discussed in the following sections.

4.2.1 Anticipated Impact on Soil Environment

Following impacts are anticipated due to mining operations:

- Removal of protective vegetation cover
- Exposure of subsurface materials which are unsuitable for vegetation establishment

4.2.2 Common Mitigation Measures from proposed project

- ❖ Run-off diversion – Garland drains will be constructed 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.

4.3 WATER ENVIRONMENT

The total water requirement for this project will be 5.9 KLD. The water will be sourced initially from outside agencies. Later the rainwater collected in the mine pit sump will be used for this purpose. The domestic effluent to be generated from the project will be collected in septic tank with soak pits arrangements. There are no waste dumps in this quarry. Based on the available information and the geophysical investigations the study concluded that the project area is considered to have poor groundwater potential. Besides, the mining area consists of hard compact rock, no major water seepage within the mine is expected.

4.3.1 Anticipated Impact

The major sources of water pollution normally associated due to mining and allied operations are:

- Generation of waste water from vehicle washing.
- Washouts from surface exposure or working areas
- Domestic sewage
- Disturbance to drainage course in the project area
- 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
- As the proposed project acquires 5.9 KLD of water from water vendors, it will not extract water by developing abstraction structures in the lease area. Therefore, the project will not deplete aquifer beneath the lease area.

4.3.2 Common Mitigation Measures for the Proposed Project

- Garland drainage system and settling tank will be constructed along the proposed mining lease area. The garland drainage will be connected to settling tank and sediments will be trapped in the settling tanks and only clear water will be discharged to the natural drainage
- Rainwater from the mining pits will be collected in sump and will be allowed to store and pumped out to surface settling tank of 15 m x 10 m x 3 m 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
- Benches will be provided with inner slopes and through a system of drains and channels, rain water will be allowed to descent into surrounding drains to minimize the effects of erosion and water logging arising out of uncontrolled descent of water
- The water collected will be reused during storm for dust suppression and greenbelt development within the mines
- Interceptor traps/oil separators will be installed to remove oils and greases. Water from the tipper wash-down facility and machinery maintenance yard will be passed through interceptor traps/oil separators prior to its reuse
- Flocculating or coagulating agents will be used to assist in the settling of suspended solids during monsoon seasons
- Periodic (every 6 month once) analysis of ground water quality of quarry pit water and ground water of nearby villages will be conducted.
- Domestic sewage from site office and 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 (once every 6 months) and analysing the quality of water in open well, bore wells and surface water.

4.4 AIR ENVIRONMENT

The air borne particulate matter is the main air pollutant by opencast mining. The mining operation will be carried out by jack hammer drilling, excavation, loading and transportation.

4.4.1 Anticipated Impact from proposed project

- During mining at various stages of activities such as excavation, drilling 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

4.4.2 Emission Estimation

Emission resulting from different mining activities is estimated using relevant empirical formulae developed by Chaulya et al.,2001. The equations used for SPM, SO_2, and NO_X emission estimation have been given in Table 4.1.

Table 4.1 Empirical Formula for Emission Rate from Overall Mine

	Pollutant	Source Type	Empirical Equation	Parameters
Overall Mine	SPM	Area	E= [u0.4a0.2{9.7+ 0.01p+b/(4+0.3b)}]	u = Wind speed(m/s); p = Mineral production (Mt/yr); b = Overburden handling (Mm^3/yr); a = Lease area(km^2); E = Emission rate(g/s).
Overall Mine	SO_2	Area	E=a0.14{u/(1.83+0.93u)} [{p/(0.48+0.57p)} +{b/(14.37+1.15b)}]	u = Wind speed(m/s); p = Mineral production (Mt/yr); b = Overburden handling (Mm^3/yr); a = Lease area(km^2); E = Emission rate(g/s).
Overall Mine	NO_X	Area	E=a0.25{u/(4.3+32.5u)} [1.5p+{b/(0.06+0.08b)}]	u = Wind speed(m/s); p = Mineral production (Mt/yr); b= Overburden handling (Mm^3/yr); a = Lease area(km^2); E = Emission rate(g/s).

The emission rate thus calculated using the empirical formula is used as one of the inputs in the AERMOD modelling. As the SPM emission calculation for overall mine is not considering pollution control measures, one-third of the SPM value is taken for derivation of PM_{10} keeping in mind that proper control measures are followed. It is important to note that PM_{10} emission rate

is derived from the SPM estimation in the background that PM_{10} constitutes 52% of SPM emission. The $PM_{2.5}$, PM_{10}, SO_2 and NO_X emission results have been given in Table 4.2.

Table 4.2 Estimated Emission Rate

Activity	Pollutant	Calculated Value (g/s)	Lease Area in m^2	Calculated Value ($g/s/m^2$)
Overall Mine	$PM_{2.5}$	0.0053974185	20150	2.67862E-07
Overall Mine	PM_{10}	0.0107948371	20150	5.35724E-07
Overall Mine	SO_2	0.0042250639	20150	2.09681E-07
Overall Mine	NO_X	0.0053666955	20150	2.66337E-07

4.4.2.1 Frame work of Computation and Model Details

By using the above-mentioned inputs, Ground Level Concentrations (GLC) 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 includes the impacts of excavation, drilling, loading and movement of vehicles during transportation and meteorological parameters such as wind speed, wind direction, temperature, rainfall, humidity and cloud cover.

The model was used to predict the impact on the ambient air environment at each receptor at various localities within 10km radius around the project site and the maximum incremental GLC at the project site. All the prediction models in Figures 4.1- 4.4 shows the maximum concentrations of $PM_{2.5}$, PM_{10}, SO_2 and NO_X close to the proposed project site due to low to moderate wind speeds.

4.4.2.2 Modelling of Incremental Concentration

The air borne particulate matter such as PM_{10} and $PM_{2.5}$ generated by quarrying operation, transportation, and wind erosion of the exposed areas and emissions of sulphur dioxide (SO_2) and oxides of nitrogen (NOx) due to excavation and loading equipment's and vehicles plying on haul roads are the significant air pollutants arising from mining operation, leading to an adverse impact on the ambient air environment in and around the project area. Anticipated incremental concentration and net increase in emissions due to quarrying activities within 500 m around the project area is predicted by open pit source modelling using AERMOD Software and the

incremental values of the air pollutants were added to the base line data monitored at the proposed site to predict total GLC of the pollutants, as shown in Tables 4.3-4.6.

4.4.2.3 Model Results

The post project resultant concentrations of PM_{10}, $PM_{2.5}$, SO_2 & NO_X (GLC) is given in Tables 4.3-4.6.

Table 4.3 Incremental & Resultant GLC of $PM_{2.5}$

Station ID	Distance to core area (km)	Direction	PM 2.5 concentrations(µg/m³)			Comparison against air quality standard (60 µg/m³)	Magnitude of Change (%)	Significance
			Baseline	Predicted	Total			
AAQ1	---	---	21.1	5.95	27.05	Below standard	28.20	Not significant
AAQ2	0.78	W	21.6	0.5	22.1		2.31	
AAQ3	1.95	SW	20.4	0	20.4		0.00	
AAQ4	4.84	WSW	16.0	0	16		0.00	
AAQ5	4.26	S	18.0	0	18		0.00	
AAQ6	2.83	NW	19.1	0.5	19.6		2.62	
AAQ7	4.90	NE	18.0	0	18		0.00	

Table 4.4 Incremental & Resultant GLC of PM_{10}

Station ID	Distance to core area (km)	Direction	PM_{10} concentrations(µg/m³)			Comparison against air quality standard (100 µg/m³)	Magnitude of change (%)	Significance
			Baseline	Predicted	Total			
AAQ1	---	---	42.6	11.9	54.5	Below standard	27.93	Not significant
AAQ2	0.78	W	39.5	0.5	40		1.27	
AAQ3	1.95	SW	39.8	0	39.8		0.00	
AAQ4	4.84	WSW	37.0	0	37		0.00	
AAQ5	4.26	S	34.9	0	34.9		0.00	
AAQ6	2.83	NW	37.0	0.5	37.5		1.35	
AAQ7	4.90	NE	39.7	0	39.7		0.00	

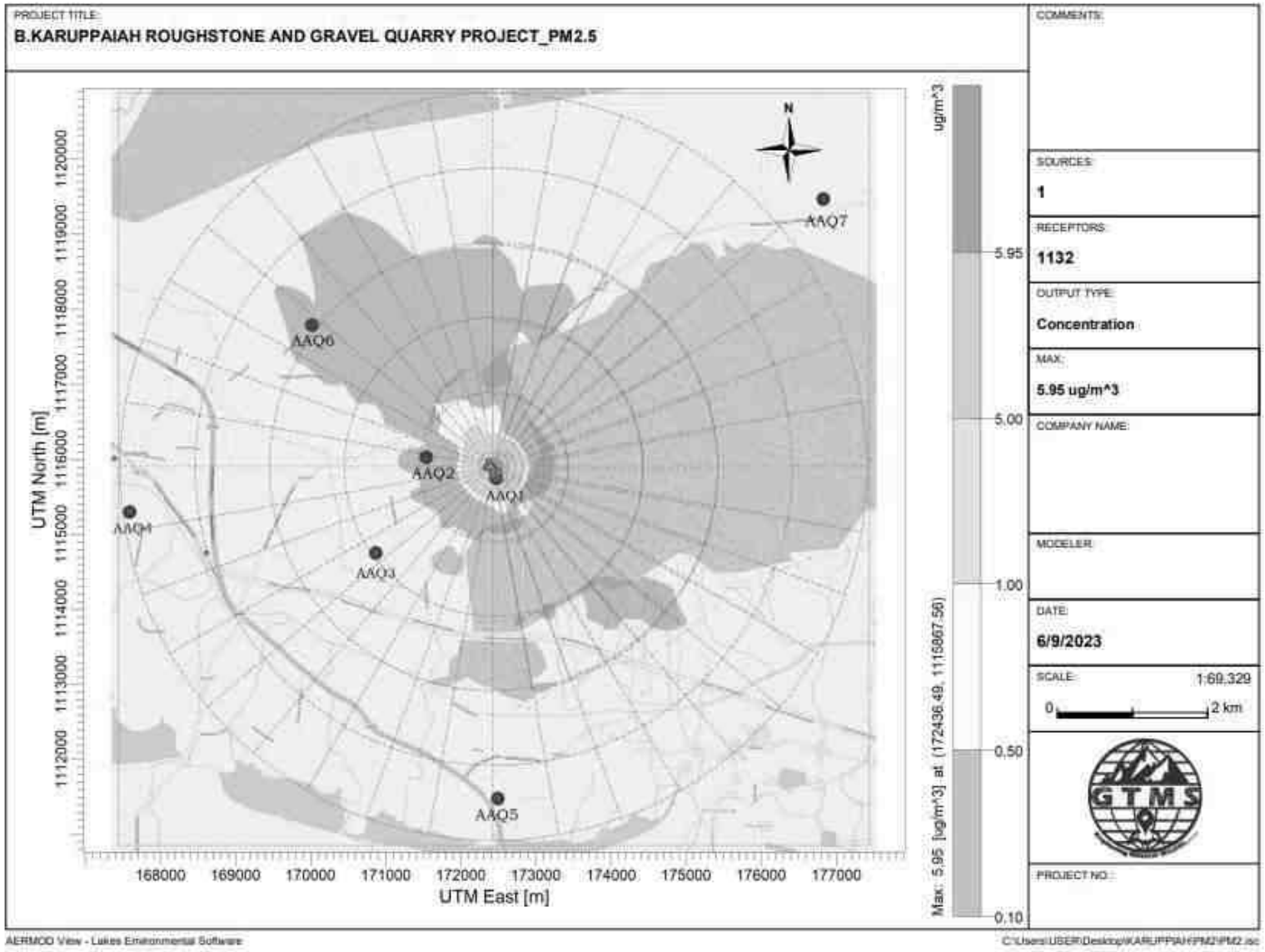


Figure 4.1 Predicted Incremental Concentration of $PM_{2.5}$

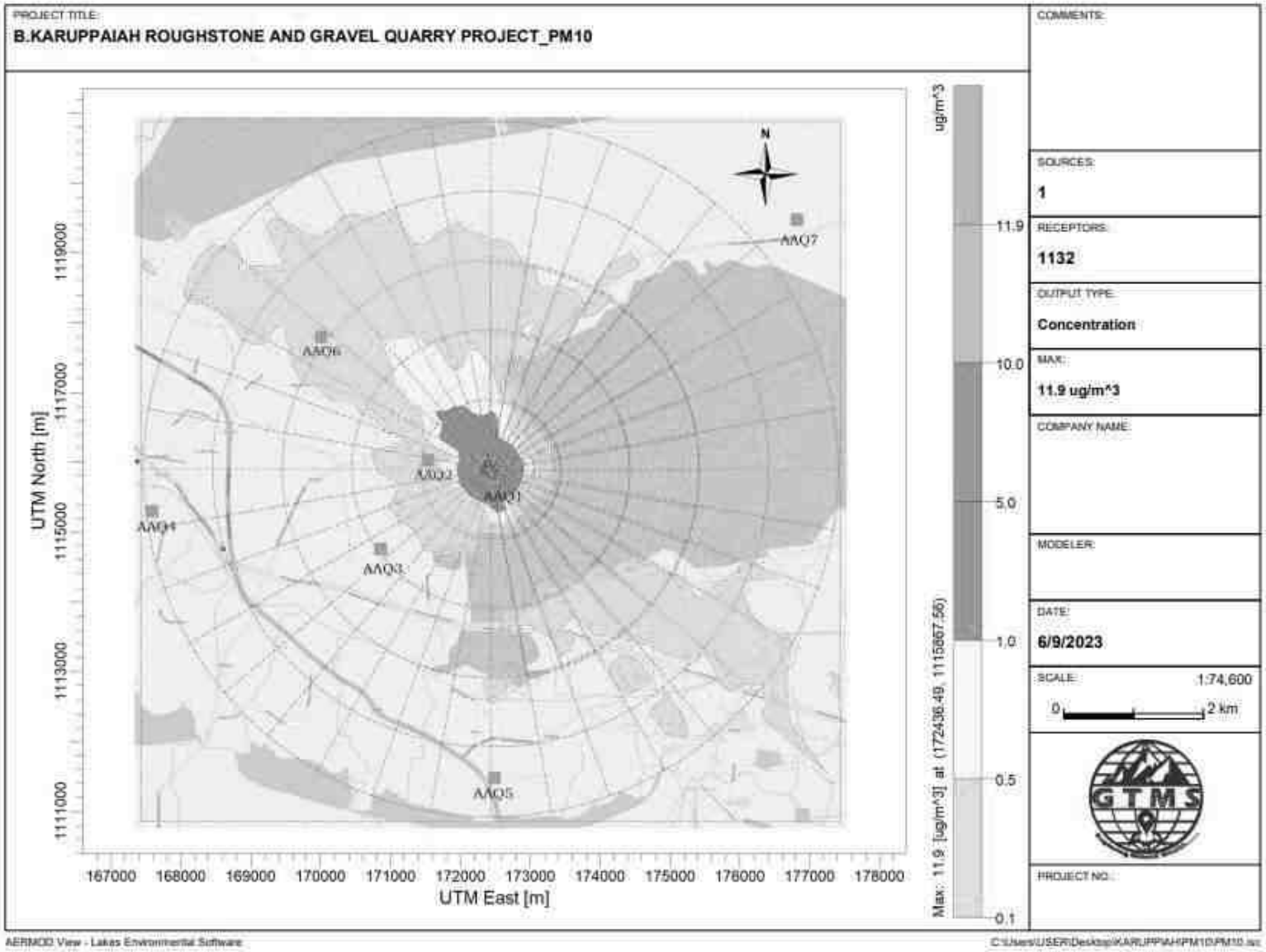


Figure 4.2 Predicted Incremental Concentration of PM_{10}

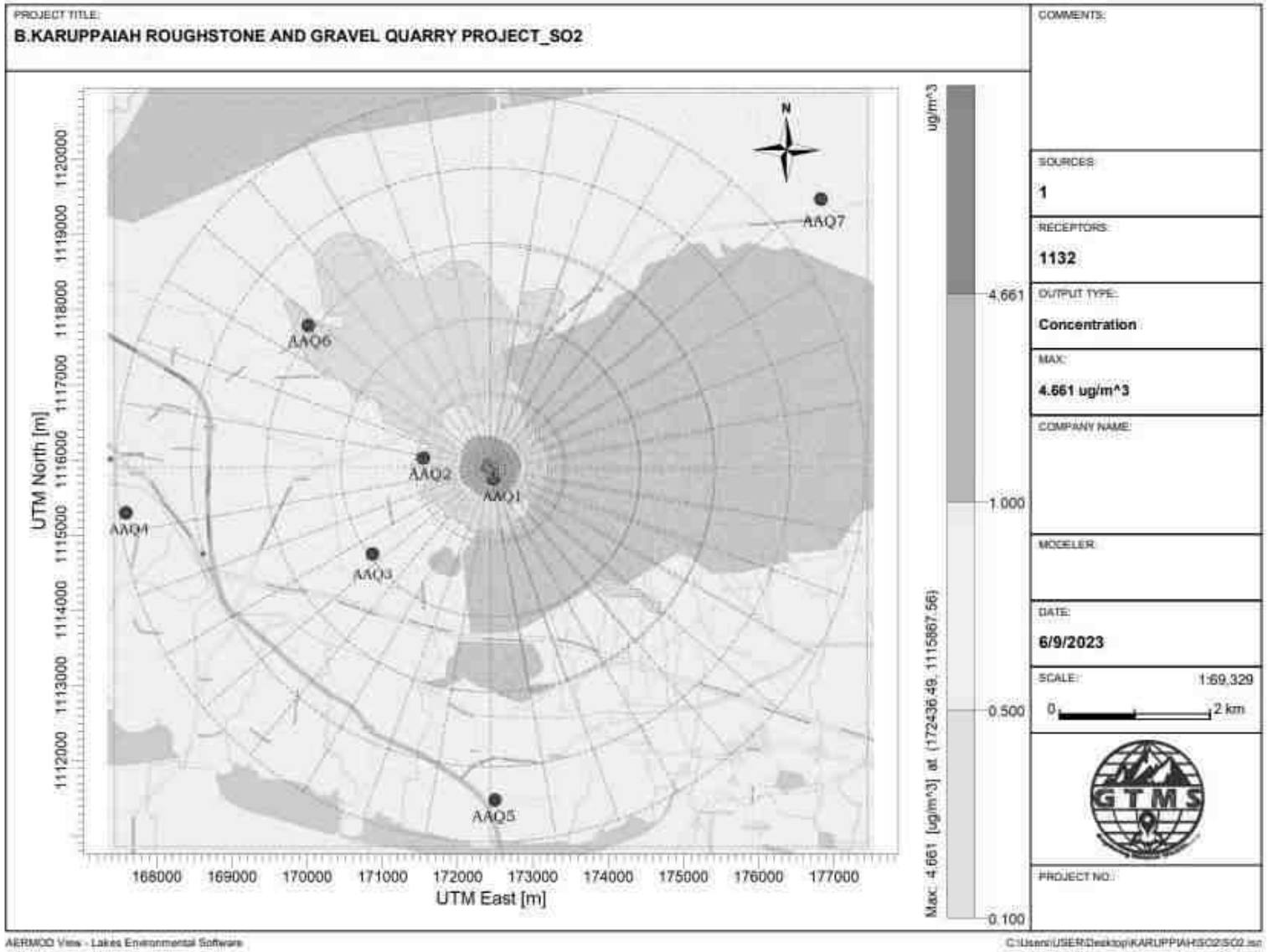


Figure 4.3 Predicted Incremental Concentration of SO_2

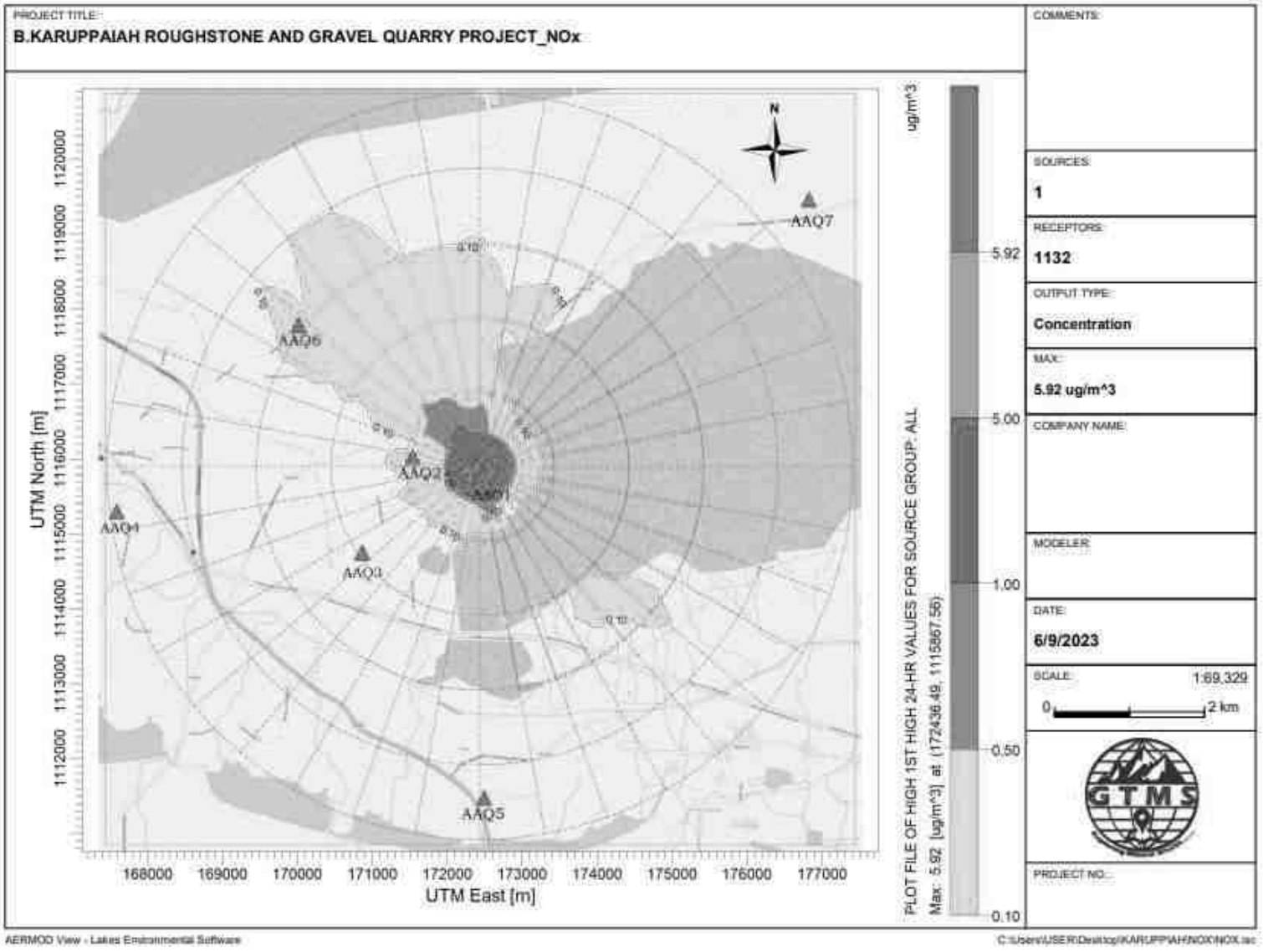


Figure 4.4 Predicted Incremental Concentration of NO_X

Table 4.5 Incremental & Resultant GLC of SO_2

Station ID	Distance to core area (km)	Direction	SO_2 concentrations(µg/m^3)			Comparison against air quality standard (80 µg/m^3)	Magnitude of change (%)	Significance
			Baseline	Predicted	Total			
AAQ1	---	---	8.4	4.66	13.06	Below standard	55.48	Not significant
AAQ2	0.78	W	8.9	0.5	9.4		5.62	
AAQ3	1.95	SW	9.5	0	9.5		0.00	
AAQ4	4.84	WSW	7.0	0	7		0.00	
AAQ5	4.26	S	8.4	0	8.4		0.00	
AAQ6	2.83	NW	10.0	0.5	10.5		5.00	
AAQ7	4.90	NE	7.3	0	7.3		0.00	

Table 4.6 Incremental & Resultant GLC of NO_X

Station ID	Distance to core area (km)	Direction	NO_X concentrations(µg/m^3)			Comparison against air quality standard (80 µg/m^3)	Magnitude of change (%)	Significance
			Baseline	Predicted	Total			
AAQ1	---	---	16.3	5.92	22.22	Below standard	36.32	Not significant
AAQ2	0.78	W	16.9	0.5	17.4		2.96	
AAQ3	1.95	SW	16.6	0	16.6		0.00	
AAQ4	4.84	WSW	11.0	0	11		0.00	
AAQ5	4.26	S	17.0	0	17		0.00	
AAQ6	2.83	NW	19.1	0.5	19.6		2.62	
AAQ7	4.90	NE	14.0	0	14		0.00	

The values of cumulative concentration i.e., background + incremental concentration of pollutant in all the receptor locations are still within the prescribed NAAQ limits without effective mitigation measures. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be controlled further.

4.4.3 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 becomes very effective and the work environment will be improved from the point of view 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

- Suitable time of blasting will be chosen according to the local conditions and water will be sprinkled on blasting face.
- Blasting will be avoided when temperature inversion is likely to occur and strong wind blows towards residential areas.
- Controlled blasting will be carried out using suitable explosive charge and short delay detonators, adequate stemming of holes at collar zone.
- Blasting will be restricted to a particular time of the day i.e., at the time of lunch hours.
- 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 and 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 tarpaulin
- The speed of tippers plying on the haul road will be limited to < 20 km/hr to avoid generation of dust
- Water sprinkling on haul roads and 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 and reduces pollution

- ❖ The un-metaled haul roads will be compacted weekly before being put into use
- ❖ Overloading of tippers will be avoided to prevent spillage
- ❖ It will be ensured that all transportation vehicles carry a valid PUC certificate
- ❖ Haul roads and service roads will be graded 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 tractors/tippers
- ❖ Green belt of adequate width will be developed around the project site

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 and tipper drivers
- ❖ Ambient air quality monitoring will be conducted every six months to assess effectiveness of mitigation measures proposed

4.5 NOISE ENVIRONMENT

Noise pollution is mainly due to operation like drilling, 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 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 a mathematical 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 and 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.

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

4.5.1 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 4.7.

Table 4.7 Activity and Noise Level Produced by Machinery

S. 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			**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 noise prediction modelling.

Table 4.8 Predicted Noise Incremental Values

Noise Monitoring Location	Distance From Project Site(m)	Baseline Noise Level (dBA)m During Day Time	Predicted Noise Level (dBA)	Total (dBA)
Core area	100	41.6	57.16	57.28

Ramayanpatti	680	40.7	40.51	43.62
Chockalingapuram	1980	40.4	31.23	40.90
Vadipatti	4870	47.5	23.41	47.52
Thanichiyam	4210	39.2	24.67	39.35
Semminipatti	2790	39.8	28.25	40.09
T. Mettupatti	4910	39.5	23.34	39.60
NAAQ Standards	Industrial Day Time - 75 dB (A) & Night Time- 70 dB (A) Residential Day Time -55 dB (A) & Night Time- 45 dB (A)			

The incremental noise level is found to be 57.16 dB (A) in core zone and ranges between 23.34 and 40.51dB (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 several factors including ground reflection, atmosphere, wind speed, temperature, trees, and buildings as 35.5 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), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment(Protection) Act, 1986.).

4.5.2 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

- ❖ Greenbelt/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

4.5.3 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 kutcha 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 is 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 given below:

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

Where,

V = peak particle velocity (mm/s)

K = site and rock factor constant (500)

Q = maximum instantaneous charge (kg)

B = constant related to the rock and site (usually 1.6)

R = distance from charge (m)

Table 4.9 Predicted PPV Values due to Blasting

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in mm/s	Fly rock distance in m	Air Blast	
					Pressure (kPa)	Sound Level (dB)
P1	11	680	0.101	19	0.02	121

Table 4.10 Predicted PPV Values due to Blasting at 100-500 m radius

Location ID	Maximum Charge in kgs	Radial Distance in m	PPV in mm/s	Fly rock distance in m	Air Blast	
					Pressure (kPa)	Sound Level (dB)
P1	11	100	2.169	19	0.24	141
		200	0.715		0.10	134
		300	0.374		0.06	130
		400	0.236		0.04	127
		500	0.165		0.03	125

4.5.3.1 Common Mitigation Measures

- The blasting operations in the cluster quarries are carried out without deep hole drilling and blasting using delay detonators which reduce the ground vibrations
- Proper quantity of explosives, 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 a greater 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 in such a way that the predicted peak particle velocity shall not exceed 0.251mm/s
- ❖ Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices.

4.6 ECOLOGY AND BIODIVERSITY

4.6.1 Impact on Ecology and Biodiversity

- 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.
- *Prosophis juliflora* is the most common weed. Six species belonging to four families have been recorded from the mine lease area. One Tree, 2 shrubs, 3 herbs were identified. It is a grassy land.
- Most of the land in the buffer area is undulating terrain with crop lands, grass patches and small shrubs. Hence, there will be no effect on flora of the region.
- Carbon released from quarrying machineries and tippers during quarrying would be 1505 kg per day, 406403 kg per year and 2032014 kg over five years, as provided in Table 4.11.

Table 4.11 Carbon Released During Five Years of Rough Stone and Gravel Production

	Per day	Per year	Per five years
Fuel consumption of excavator	96	25919	129594
Fuel consumption of compressor	11.2	3024	15120
Fuel consumption of tipper	454	122700	613500
Total fuel consumption in liters	562	151643	758214
Co_2 emission in kg	1505	406403	2032014

4.6.2 Mitigation Measures on Flora

- ❖ During conceptual stage, the top bench will be re-vegetated by planting local /native species and lower benches will be converted into rainwater harvesting structure following completion of mining activities, which will replace habitat resources for fauna species in this locality over a longer time.
- ❖ Existing roads will be used; new roads will not be constructed to reduce impact on flora.
- ❖ 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 tractors/tippers
- ❖ Green belt of adequate width will be developed around the project site

Carbon Sequestration

- To mitigate carbon emission due to mining activities, we recommend planting trees around the quarry to offset the carbon emission during quarrying. A tree can sequester 24 kg of carbon per year. Therefore, we recommend planting large number of trees around the quarry and near school campuses, government wasteland, roadsides etc.
- As per the greenbelt development plan as recommended by SEAC (Table 4.13), about **1008** trees will be planted within three months from the beginning of mining. These trees, when grown up would sequester carbon of about 89 kg of the total carbon, as provided in Table 4.12.

Table 4.12 CO_2 Sequestration

CO_2 sequestration in kg	89	24156	120779
Remaining CO_2 not sequestered in kg	1416	382247	1911235
Trees required for environmental compensation	15927		
Area required for environmental compensation in hectares	32		

Greenbelt Development

The main objective of the green belt is to provide a barrier between the source of pollution and the surrounding areas. In order to compensate the loss of vegetation cover, it is suggested to carry out afforestation program mainly inside and outside of the lease area in different phases. This habitat improvement program would ensure the faunal species to re-colonize and improve the abundance status in the core zone. Greenbelt development plan and budget required for green belt development plan are given in Tables 4.14-4.15. For greenbelt development, species are recommended, as shown in Table 4.12 on the basis of:

- Natural growth of existing species and survival rate of various species.
- Suitability of a particular plant species for a particular type of area.
- Creating of biodiversity.
- Fast growing, thick canopy copy, perennial and evergreen large leaf area.
- Efficient in absorbing pollutants without major effects of natural growth.

Table 4.13 Recommended Species for Greenbelt Development Plan

S. No	Botanical Name of the Plant	Family Name	Common Name	Category	Dust Capturing Efficiency Features
1	*Azadirachta indica*	Meliaceae	Neem, Vembu	Tree	Well distinct thick at both the layer
2	*Techtona grandis*	Lamiaceae	Teak	Tree	

3	*Polyalthia longifolia*	Annonaceae	Nettilingam	Tree	Well distinct in Palisade & Spongy parenchyma. Spongy parenchyma is present at lower epidermis Many vascular bundles arranged almost parallel series
4	*Albizia lebbeck*	Fabaceae	Vagai	Tree	
5	*Delonix regia*	Fabaceae	Cemmayir-konrai	Tree	
6	*Bauhinia racemosa*	Fabaceae	Aathi	Tree	
7	*Cassia fistula*	Fabaceae	Sarakondrai	Tree	
8	*Aegle marmelos*	Rutaceae	Vilvam	Tree	
9	*Pongamia pinnata*	Fabaceae	Pungam	Tree	
10	*Thespesia populnea*	Malvaceae	Puvarasu	Tree	

Table 4.14 Greenbelt Development Plan

	No. of trees proposed for plantation	**No. of trees expected to survive @ 80%**	**Area to be covered(m^2)**
Plantation in the construction phase (3 months)	Number of plants inside the mine lease area		
	403	322	3627
	Number of plants outside the mine lease area		
	605	484	5441
Total	**1008**	**806**	**9068**

Table 4.15 Budget for Greenbelt Development Plan

Activity	**Plantation in the construction phase(3Months)**	**Cost**	**Capital Cost (Rs.)**	**Recuring Cost-per annum**
Plantation inside the mine lease area (in safety margins)	403	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))"	80600	12090

Plantation outside the area	605	Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	181350	18135
Total			**261950**	**30225**

Source: EMP budget

After complete extraction of mineral, the excavated pits will be allowed to collect rainwater and seepage water to serve as a reservoir to charge the nearby wells. Fish culture will also be attempted. A bund will be constructed around the pits. In order to minimize the impact of mining on the vegetation outside the mine lease area, it is recommended that adequate protection measures must be implemented. As mining involves movement of vehicles and increased anthropogenic activities, some of the areas can be fenced by involving local people and educating them about increased benefits of such activities.

4.6.3. Anticipated Impact on Fauna

- There is no Wildlife Sanctuary and Biosphere Reserve within 10 km radius of the project site.
- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice scientific method of mining with proper Environmental Management Plan including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.
- Fencing around all the proposed mine lease areas will be constructed 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.

4.6.4 Measures for Protection and Conservation of Wildlife Species

- All the preventive measures will be taken for growth & development of fauna.
- Creating and development awareness for nature and wildlife in the adjoin 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.
- Undertaking mitigation measures for conducive environment to the flora and fauna in consultation with Forest Department.
- Dust suppression system will be installed within mine and periphery of mine for proposed project

- ❖ Plantation around mine area will help in creating habitats for small faunal species and to
- ❖ create better environment for various fauna. Creating and developing awareness for nature and wildlife in the adjoining villages.

Aquatic Biodiversity

Mining activities will not disturb the existing aquatic ecology as there is no effluent discharge proposed from the rough stone and gravel quarry. There is no natural perennial surface water body within the mine lease area. Hence, aquatic biodiversity is not observed in the mine lease area.

Table 4.16 Ecological Impact Assessments

S. No	Attributes	Assessment
1	Activities of the project affects the breeding/nesting sites of birds and animals	No breeding and nesting sites were identified in the lease area.
2	Located near an area populated by rare or endangered species	No endangered, critically endangered, vulnerable species were sighted in core area.
3	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	1) Waguthumalai reserve forest is located in 0.63 km East 2) Sirumalai reserve forest is located in 4.42 km North West. 3) Kulasekarankottai reserve forest is located in 5.58 km North West. 4) Sembatti reserve forest is located in 7.49 km North East. 5) Viralipatti reserve forest is located in 5.16 km East. There is no wildlife sanctuary within 10km radius.
4	Proposed project restricts access to waterholes for wildlife	No. The proposed project does not restrict access to water holes for wildlife.
5	Proposed mining project impact surface water quality that also provide water to wildlife	No scheduled or threatened wildlife animal were sighted in core area.
6	Proposed mining project increase siltation that would affect nearby biodiversity area.	Surface runoff management system will be developed properly. So, there will be no siltation in nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities	Barbed wire fencing will be installed around the lease area. Therefore, wild animals will not fall into the quarry pit.
8	The project release effluents into a water body that also supplies water to a wildlife	No water bodies were found close to core zone so chances of water becoming polluted will be low.

9	Mining project effect the forest-based livelihood/ any specific forest product on which local livelihood depended	No. The proposed project does not involve any forestland. Therefore, it will not affect the livelihood of people depending the forest product.
10	Project likely to affect migration routes	No migration routes were found crossing the lease area.
11	Project likely to affect flora of an area, which have medicinal value	No flora with medicinal values were found in the study area.
12	Forestland is to be diverted, has carbon high sequestration	As the proposed project does not involve any forestland, there will be no need for diversion.
13	The project likely to affect wetlands, fish breeding grounds, marine ecology	Wetland was not present in and around mining lease area. No fish breeding grounds were present in core area.

Table 4.17 Anticipated Impact of Ecology and Biodiversity

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)	Site possesses common floral (not trees) species. Clearance of these species will not result in loss of flora	Less severe	No immediate action required. However, Greenbelt /plantation will be developed in project site and in periphery of the project boundary, which will
		Site specific loss of associated faunal diversity (Partial impact)	Site supports only common species, which use 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 form Unique / critical habitat structure for unique flora or fauna.		improve flora and fauna diversity of the project area.
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 generation of dust (SPM) due to haul roads and emission of SO_2, NO_2, CO 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 far from core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantation has been suggested Upgrade the vehicles with alternative fuel such biodiesel, methanol and biofuel around the mining area.

4.7 SOCIO ECONOMIC ENVIRONMENT

4.7.1 Anticipated Impact from Proposed and Existing Projects

- 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.

4.7.2 Common Mitigation Measures for Proposed Project

- 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

4.8 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

4.8.1 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

4.8.2 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.

4.8.3 Physical Hazards

The following measures are proposed for control of physical hazards

- Specific personnel training on work-site safety management will be taken up;
- 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.

4.8.4 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.

4.9 MINE WASTE MANAGEMENT

No waste is anticipated from any of the proposed quarries.

4.10 MINE CLOSURE

Mine closure plan is the most important environmental requirement in mining project. 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.

4.10.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.10.1.1 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.,

4.10.1.2 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.

4.10.1.3 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.
- Where it is desirable to get a quick growth response from the native flora during those times when moisture is not a limiting factor. For example, development of green barriers

The Mine closure plan should be as per the approved mining 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.

CHAPTER V
ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.0 INTRODUCTION

Consideration of alternatives to a proposed project is a requirement of EIA process. During the scoping process, alternatives to a proposed project 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.

5.1 FACTORS BEHIND THE SELECTION OF PROJECT SITE

The proposed project is site specific and has the 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 area.
- 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.
- As the proposed project area falls in seismic zone II, there is no major history of landslides, earthquake, subsidence etc., recorded in the past history.

5.2 ANALYSIS OF ALTERNATIVE SITE

No alternatives are suggested as the mine site is mineral specific.

5.3 FACTORS BEHIND SELECTION OF PROPOSED TECHNOLOGY

Manual open cast mining method with secondary blasting will be applied to extract rough stone and gravel in the area. The proposed mining lease areas have following advantages:

- As the mineral deposition is homogeneous and batholith formation, opencast method of working is preferred over underground method.
- The material will be loaded with the help of excavators into tractors/tippers and transported to the need by customers.
- Semi-skilled labours fit for quarrying operations are easily available around the nearby villages.

5.4 ANALYSIS OF ALTERNATIVE TECHNOLOGY

Open cast mechanized method has been selected for this project. 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.

CHAPTER VI

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-TN 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 project; 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 the proposed quarry. 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 the proposed project proponent. The half-yearly reports are submitted to Ministry of Environment and Forest, Regional Office and SEIAA-TN 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). The Environmental Monitoring Cell will be formed for the proposed project. The structure of the cell will be as shown in Figure 6.1.

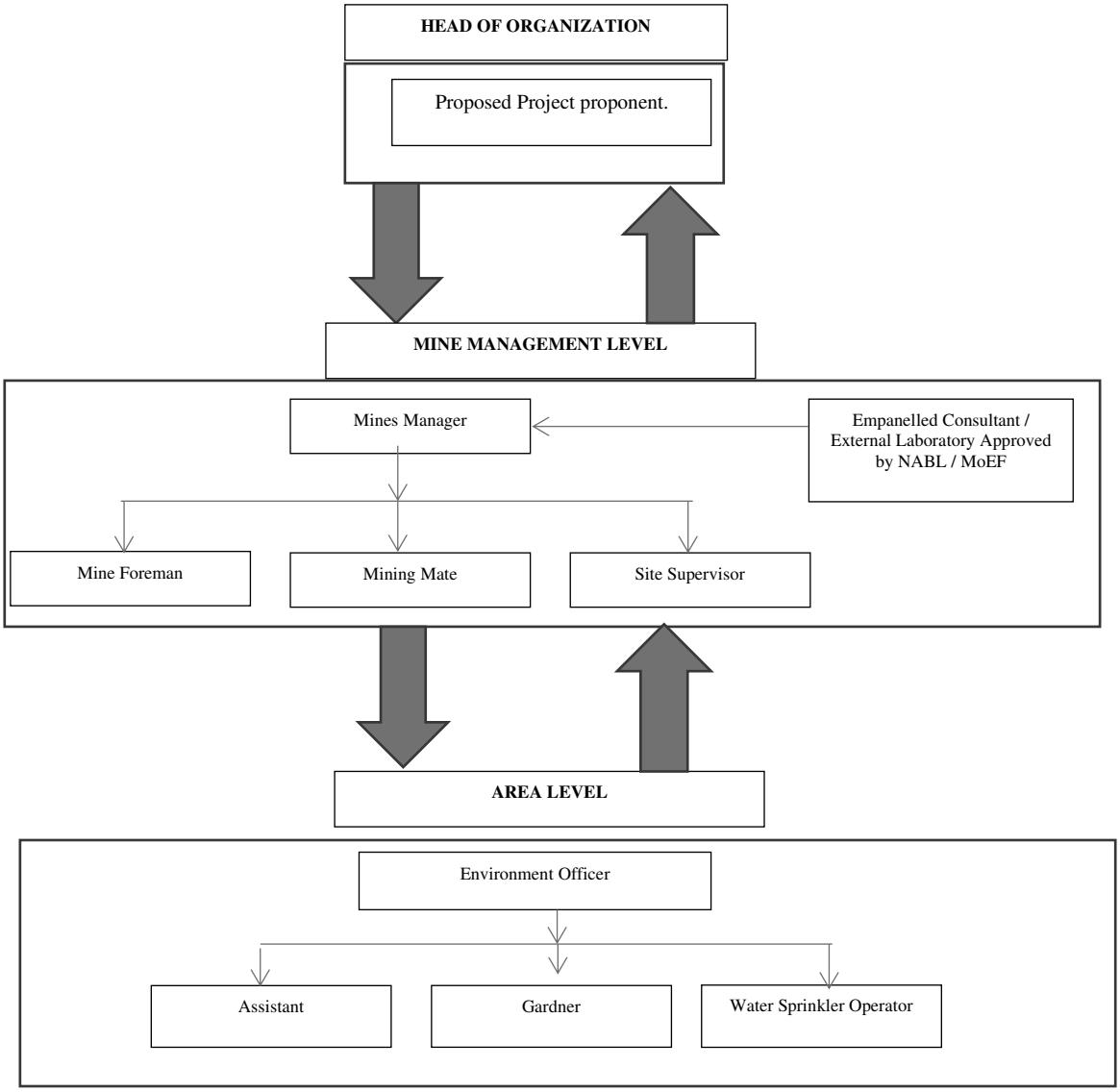


Figure 6.1 Proposed environmental monitoring chart

6.2 IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES

The mitigation measures proposed in chapter IV 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

S. 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 proposed monitoring schedule have been provided in Table 6.2.

Table 6.2 Proposed Monitoring Schedule Post EC for the Proposed Quarry

S. No.	Environment Attributes	Location	Monitoring		Parameters
			Duration	Frequency	
1	Air Quality	2 Locations (1 Core & 1 Buffer)	24 hours	Once in 6 months	Fugitive Dust, $PM_{2.5}$, PM_{10}, SO_2 and NO_x.
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	2 Locations (1SW & 1 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 m BGL
5	Noise	2 Locations (1 Core & 1 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	2 Locations (1 Core & 1 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 ENVIRONMENT MONITORING PROGRAM

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 recurring cost for Environmental Monitoring Programme is Rs **2,95,000 /-** per annum for the proposed project site.

Table 6.3 Environment Monitoring Budget

S. No.	Parameter	Capital Cost	Recurring Cost per annum
1	Air Quality	-	Rs 60,000/-
2	Meteorology	-	Rs 15,000/-
3	Water Quality	-	Rs 20,000/-
4	Water Level Monitoring		Rs 10,000/-
5	Soil Quality	-	Rs 20,000/-
6	Noise Quality	-	Rs 10,000/-
7	Vibration Study	-	Rs 1,50,000/-
8	Greenbelt	-	Rs 10,000/-
Total		**-**	**Rs 2,95,000 /-**

Source: Field Data

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.

CHAPTER VII
ADDITIONAL STUDIES

7.0 GENERAL

Additional studies deal with:

- Risk Assessment
- Disaster Management Plan
- Cumulative Impact Study
- Plastic Waste Management
- Post-COVID Health Management Plan

7.1 PUBLIC CONSULTATION FOR PROPOSED PROJECT

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 was made and the public opinions on the proposed project will be updated in the final EIA/EMP report.

7.2 RISK ASSESSMENT FOR PROPOSED PROJECT

Risk Assessment is all about prevention of accidents and to take necessary steps to prevent it from happening. The methodology for the risk assessment is 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 proposed project.

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 Table 7.1.

Table 7.1 Risk Assessment & Control Measures for Proposed Project

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.
3	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 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
4	Natural calamities	Unexpected happenings	✓ Escape Routes will be provided to prevent inundation of storm water ✓ Fire Extinguishers & Sand buckets
5	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.

Source: Analysed and Proposed by FAE & EC

7.3 DISASTER MANAGEMENT PLAN FOR PROPOSED PROJECT

Natural disasters like Earthquake, Landslides have not been recorded in the past history as the terrain is categorized under seismic zone II. 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. Structure of the team has been shown in Figure 7.1.

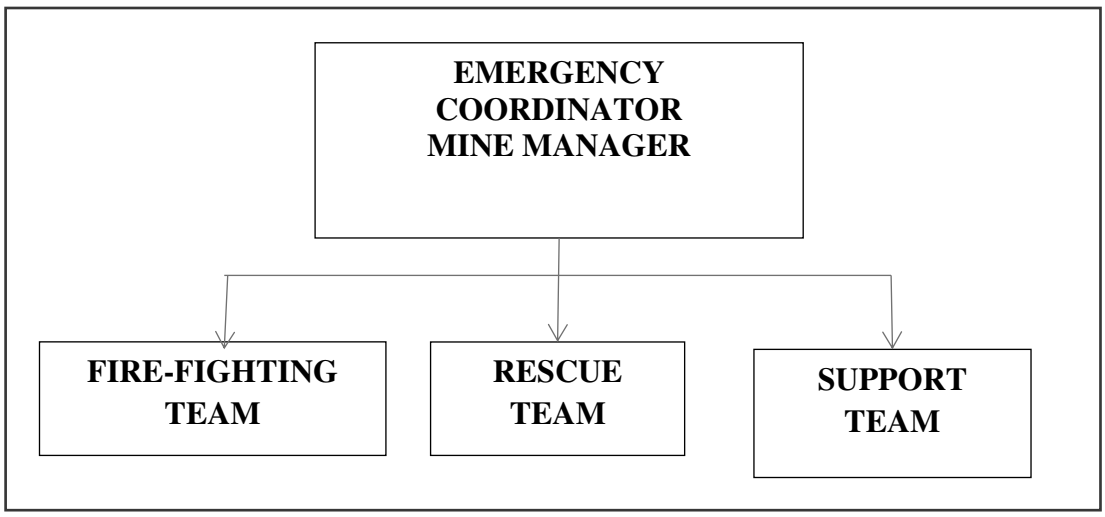


Figure 7.1 Disaster management team layout for proposed project

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 for 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.

7.3.1 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.,

7.3.2 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

7.3.3 Proposed Fire Extinguishers

The following type of fire extinguishers has been proposed at strategic locations within the mine, as shown in Table 7.3.

Table 7.3 Proposed Fire Extinguishers at Different Locations in P1

Location	Type of Fire Extinguishers
Electrical Equipment	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

7.3.4 Alarm System

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.

- 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.
- 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.
- Regular maintenance and testing of all mining equipment were carried out as per manufacturer's guidelines.

7.4 CUMULATIVE IMPACT STUDY

The Cumulative Impact is mainly anticipated due to drilling & blasting and excavation and transportation activities in all the quarries within the cluster and major impact anticipated is on Air & Noise Environment and Ground Vibrations due to blasting. For this cumulative study, 4 proposed projects, known as P1, P2, P3, P4 are taken into consideration. The details of P1 have been given in Table 1.2 and the details of P2, P3, P4 are given in Table :7.4, 7.5 and 7.6

Table 7.4 Salient Features of the Proposed Project 'P2'

Name of the Quarry	Thiru.A.D. Meenatchi Sundaram Rough Stone and Gravel Quarry		
Type of Land	Patta Land		
Extent	1.62.0 ha		
S.F.No	1168/25, 1171/3, 1171/5		
Toposheet No	58-J/04		
Latitude	10°04'53.29''N to 10°04'57.04''N		
Longitude	78°00'49.19''N to 78°00'57.83''N		
Highest Elevation	211 m AMSL		
Existing Pit Dimensions	Length (m)	Width (m)	Depth (m)
	102	75	37
Ultimate depth of Mining	37m (2m Gravel + 35m rough Stone)		
Geological Resources	Rough Stone in m^3	Gravel in m^3	
	567000	32400	
Mineable Reserves	Rough Stone in m^3	Gravel in m^3	
	132700	18930	
Proposed reserves for five years	Rough Stone in m^3	Gravel in m^3/2 years	
	132700	18930	
Method of Mining	Open-Cast Semi Mechanized mining		
Topography	Flat Terrain		
Machinery proposed	Jack Hammer	1	
	Compressor	1	

	Tipper	4
	Excavator	1
Blasting Method	The quarrying operation is proposed to carried out by open cost, using jack hammer drilling followed by manual breaking will be adopted to release the rough stone and nonel blasting is proposed in this lease area.	
Proposed Manpower Deployment	19 Nos	
Project Cost	Rs. 39,64,000	
CER Cost @ 2% of Project Cost	Rs. 5,00,000/-	
Proposed Water Requirement	2.0 KLD	

Table 7.5 Salient Features of the Proposed Project 'P3'

Name of the Quarry	Thiru.R. Kannan Rough Stone and Gravel Quarry	
Type of Land	Patta Land	
Extent	1.91.0	
S.F.No	1168/7,1168/9,1168/19	
Toposheet No	58 J/04	
Latitude	10°04'58.20''N to 10°5'2.88''N	
Longitude	78°0'47.95''N to 78°0'54.69''N	
Highest Elevation	223 m AMSL	
Ultimate depth of Mining	30 m	
Geological Resources	Rough Stone in m^3	Top Soil in m^3
	461116	4050
Mineable Reserves	Rough Stone in m^3	Top Soil in m^3
	174657	1514

Proposed reserves for five years	Rough Stone in m^3	Top Soil in m^3/2 years
	174657	1514
Method of Mining	Open-Cast Semi Mechanized mining	
Topography	Flat Terrain	
Machinery proposed	Jack Hammer	2
	Compressor	1
	Tipper	2
	Excavator	1
Blasting Method	The quarrying operation is proposed to carried out by open cost, using jack hammer drilling followed by manual breaking will be adopted to release the rough stone and nonel blasting is proposed in this lease area.	
Proposed Manpower Deployment	26 Nos	
Project Cost	Rs.30,45,000	
CER Cost @ 2% of Project Cost	Rs. 5,00,000/-	
Proposed Water Requirement	2.76 KLD	

Table 7.6 Salient Features of the Proposed Project 'P4'

Name of the Quarry	M/s.Concretia Rock Product (Pvt) Ltd., Rough Stone and Gravel Quarry	
Type of Land	Patta	
Extent	1.79.5	
S.F.No	1185/1, 1185/7A, 1185/8	
Toposheet No	58 J/4	
Latitude	10°04'36.80''N to 10°4'28.87''N	
Longitude	78°0'34.18''N to 78°0'30.79''N	
Highest Elevation	212 AMSL	
Ultimate depth of Mining	48 m	
Geological Resources	Rough Stone in m^3	Gravel in m^3
	823275	54885

Mineable Reserves	Rough Stone in m^3	Gravel in m^3
	126510	20889
Proposed reserves for five years	Rough Stone in m^3	Gravel in m^3/2 years
	126510	20889
Method of Mining	Open-Cast Semi Mechanized mining	
Topography	Flat Terrain	
Machinery proposed	Jack Hammer	5
	Compressor	1
	Tipper	3
	Excavator	2
Blasting Method	The quarrying operation is proposed to carried out by open cost, using jack hammer drilling followed by manual breaking will be adopted to release the rough stone and nonel blasting is proposed in this lease area.	
Proposed Manpower Deployment	15 Nos	
Project Cost	Rs.50,60,000	
CER Cost @ 2% of Project Cost	Rs. 5,00,000/-	
Proposed Water Requirement	1.90 KLD	

7.4.1 Air Environment

As the production of rough stone and gravel plays a vital role in affecting the air environment. The data on the cumulative production resulting from the proposed project have been given in Tables 7.7 and 7.8.

Table 7.7 Cumulative Production Load of Rough Stone

Proposed Production Details				
Quarry	**5 Years in m^3**	**Per Year in m^3**	**Per Day in m^3**	**Number of Lorry Load Per Day**
P1	156188	31238	116	19
P2	132700	26540	98	16
P3	174657	34931	129	22
P4	126510	25302	94	16
Total	**590055**	**118011**	**437**	**73**

Table 7.8 Cumulative Production Load of Gravel

Quarry	Production for 1 Year (m^3)	Yearly Production (m^3)	Daily Production (m^3)	Number of Lorry Loads Per Day
P1	27862	5572	21	4
P2	18930	3786	14	2
P3	-	-	-	-
P4	20889	41779	155	26
Grand Total	**67681**	**51137**	**190**	**32**

The cumulative study shows that the overall production of rough stone from the quarry is 437 m^3 per day with a capacity of 73 trips of rough stone per day and that production of gravel from the proposed quarry is 190 m^3 per day accounting for 32 trips/day.

7.4.1.1 Cumulative Impact of Air Pollutants

The results on the cumulative impact of the 4 proposed projects on air environment of the cluster have been provided in Table 7.9. The cumulative values resulting from the 4 projects for each pollutant do not exceed the permissible limits set by CPCB.

Table 7.9 Cumulative Impact Results from the 4 proposed projects

Pollutants	Baseline Data (µg/m^3)	Incremental Values (µg/m^3)				Cumulative Value (µg/m^3)
		P1	P2	P3	P4	
$PM_{2.5}$	21.1	5.95	5.06	6.65	4.82	43.58
PM_{10}	42.6	11.9	10.11	13.31	9.64	87.56
SO_2	8.4	4.66	3.96	5.21	3.77	26
NO_2	16.3	5.92	5.03	6.62	4.82	38.69

7.4.2 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.

Table.7.10 Cumulative Impact of Noise from 4 Proposed Quarries on Ramayanpatti Habitation

Location ID	Distance (m)	Direction	Background Value (Day) dB(A)	Incremental Value dB(A)	Total Predicted dB(A)	Residential Area Standards dB (A)
Habitation Near P1	680 m	W	40.7	40.51	43.62	55
Habitation Near P2	1020 m	W	40.7	36.99	42.24	
Habitation Near P3	1015 m	W	40.7	37.03	42.25	
Habitation Near P4	740 m	NW	40.7	39.78	43.27	
Cumulative Noise (dB (A))					**48.65**	

Source: Lab Monitoring Data

The cumulative analysis of noise due to 4 proposed projects shows that habitation of Ramayanpatti will receive about 48.65 dB (A), respectively. The cumulative results for all the villages in consideration do not exceed the limit set by CPCB for residential areas for day time.

Ground Vibrations

Cumulative results of ground vibrations due to mining activities in the all the 5 mines have been shown in Table 7.11.

Table 7.11 Cumulative Effect of Ground Vibrations Resulting from 5 Mines on Habitation of Ramayanpatti

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in mm/s
P1	11	680	0.101
P2	10	1020	0.048
P3	13	1015	0.060
P4	9	740	0.074
E1	26	580	0.257
Total			**0.54**

Results from the above tables 7.12-7.13 indicate that the cumulative PPV value of each habitation 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.

7.4.3 Socio Economic Environment

Socio Economic benefits of the proposed project were calculated and the results have been shown in Table 7.12 the project together will contribute Rs. 17724300/- towards CER fund.

Table 7.12 Socio Economic Benefits from 4 Mines

Location ID	Project Cost	CER Cost @ 2%
P1	Rs.56,55,300	Rs. 5,00,000
P2	Rs. 39,64,000	Rs. 5,00,000
P3	Rs.30,45,000	Rs. 5,00,000
P4	Rs.50,60,000	Rs. 5,00,000
Grand Total	**Rs.1,77,24,300**	**Rs. 20,00,000**

Table 7.13 Employment Benefits from 4 Mines

Location ID	Employment
P1	19
P2	19
P3	26
P4	15
Grand Total	**79**

A total of 79 people will get employment due to 4 proposed mines in cluster

7.4.4 Ecological Environment

Table 7.14 Greenbelt Development Benefits From Mine

Code	Number of Trees proposed	Area to be covered (m^2)	No. of Trees expected to be grown @ 80% survival rate	Species recommended
P1	1008	9067	806	*Azadirachta indica, Albizia lebbeck, Delonix regia, Techtona grandis,* etc.,
P2	810	7290	648	

P3	955	8595	764	
P4	898	8077	718	
Total	**3671**	**33029**	**2936**	

Cumulative studies show that the proposed project will plant about 3671 native tree species like *Azadirachta indica*, *Albizia lebbeck*, *Delonix regia*, *Techtona grandis,* etc inside and outside the lease area. It is expected that 80 % of trees, i.e., 2936 trees will survive in this green belt development program.

7.5 PLASTIC WASTE MANAGEMENT PLAN FOR PROPOSED PROJECT

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.

7.5.1 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.

A detailed action plan to manage plastic waste has been provided in Table 7.15.

Table 7.15 Action Plan to Manage Plastic Waste

S. 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 FAEs and EC

7.6 POST COVID HEALTH MANAGEMENT PLAN FOR PROPOSED PROJECT

COVID – 19 diseases caused by SARS-CoV-2 Coronavirus is relatively a new disease, with fresh information being known on a dynamic basis about the natural history of the disease, especially in terms of post-recovery events.

After acute COVID-19 illness, recovered patients may continue to report wide variety of signs and symptoms including fatigue, body ache, cough, sore throat, difficulty in breathing, etc. As of now there is limited evidence of post-COVID sequalae and further research is required and is being actively pursued. A holistic approach is required for follow up care and well-being of all post COVID recovering patients.

7.6.1 Post-COVID Follow up Protocol

- ❖ Continue COVID appropriate behaviour (use of mask, hand & respiratory hygiene, physical distancing).
- ❖ Drink adequate amount of warm water (if not contra-indicated).
- ❖ Make sure your workplaces are clean and hygienic
- ❖ Surfaces (e.g., desks and tables) and objects (e.g., telephones, helmet) need to be wiped with disinfectant regularly
- ❖ Put sanitizing hand rub dispensers in prominent places around the workplace. Make sure these dispensers are regularly refilled
- ❖ Display posters promoting hand-washing

- ❖ Make sure that staff, contractors and customers have access to places where they can wash their hands with soap and water
- ❖ Display posters promoting respiratory hygiene.
- ❖ Brief your employees, contractors and customers that if COVID-19 starts spreading in your community anyone with even a mild cough or low-grade fever (37.3°C or more) need to stay at home. They should also stay home (or work from home) if they have had to take simple medications, such as paracetamol/acetaminophen, ibuprofen or aspirin, which may mask symptoms of infection
- ❖ Keep communicating and promoting the message that people need to stay at home even if they have just mild symptoms of COVID-19.
- ❖ Consider whether a face-to-face meeting or event is needed. Could it be replaced by a teleconference or online event?
- ❖ Could the meeting or event be scaled down so that fewer people attend?
- ❖ Pre-order sufficient supplies and materials, including tissues and hand sanitizer for all employees. Have surgical masks available to offer anyone who develops respiratory symptoms.
- ❖ It is also suggested by the Ministry of AYUSH that the use of Chyawanprash in the morning (1 teaspoonful) with Luke warm water/milk is highly recommended (under the direction of Registered Ayurveda physician) as in the clinical practice Chyawanprash is believed to be effective in post-recovery period.
- ❖ If there is persistent dry cough / sore throat, do saline gargles and take steam inhalation. The addition of herbs/spices for gargling/steam inhalation. Cough medications, should be taken on advice of medical doctor or qualified practitioner of Ayush.
- ❖ Look for early warning signs like high grade fever, breathlessness, Sp 0_2 < 95%, unexplained chest pain, new onset of confusion, focal weakness.
- ❖ Avoid smoking and consumption of alcohol.
- ❖ Communicate to your employees and contractors about the plan and make sure they are aware of what they need to do – or not do – under the plan. Emphasize key points such as the importance of staying away from work even if they have only mild symptoms or have had to take simple medications (e.g., paracetamol, ibuprofen) which may mask the symptoms.
- ❖ The plan should address how to keep your business running even if a significant number of employees, contractors and suppliers cannot come to your place of business - either due to local restrictions on travel or due to illness.

CHAPTER VIII
PROJECT BENEFITS

8.0 GENERAL

The proposed project at Katchaikatti Village aims to produce **156188 m^3** of rough stone and **27862 m^3** of gravel 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 19 persons for carrying out mining operations and give preference to the local people in providing employment in this cluster. In addition, there will be an opportunity for indirect employment to the form of contractual jobs, business opportunities, and service facilities etc. Because of this, the economic status of the local people will improve.

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 project is located in Katchaikatti Village, Vadipatti Taluk, Madurai District, Tamil Nadu. The area has already well-established communications roads and other facilities. The following physical infrastructure facilities will further improve due to proposed project.

- 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.,

8.6 CORPORATE SOCIAL RESPONSIBILITY

Individual project proponents 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 proponents will take-up following programmes for social and economic development of villages within 5 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 mainly contributing to education, health, training of women self-help groups and infrastructure etc., will be taken up in the Katchaikatti Village. CSR budget is allocated as 2.5% of the profit.

8.7 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, the proposed project shall contribute 2% of capital investment towards CER as per directions of EAC/SEAC. However, the SEAC has suggested to allocate CER fund on the basis of the extent of the project. Therefore, Rs. 5,00,000 is allocated for CER. The proposed utilization of the budget of CER activities is given in Table 8.1.

Table 8.1 CER Action Plan

S. No.	Activity	Budget (Rs.in Lakh)
1	The applicant Indents to involve in corporate environment responsibilities (CER) activities such as renovation of existing toilet, plantation within the school premises, donating environment related books to the nearby school library, etc.	Rs.5,00,000
	Total	**Rs.5,00,000**

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

8.8 SUMMARY OF PROJECT BENEFITS

The project would pay about **Rs. 1,34,88,946** to the state government through various ways, as provided in Table 8.2.

Table 8.2 Project Benefits to the State Government

Particulars	Budget for Rough stone (Rs.)	Budget for Gravel (Rs.)
CER	5,00,000	-----
Seigniorage @ Rs.59/m^3 of rough stone Rs.33/m^3 of Gravel	92,15,092	9,19,446
District Mineral Foundation Tax @ 10% of Seigniorage	9,21,509	91,9445
Green Tax @ 10% of Seigniorage	9,21,509	91,945
Total	**1,15,58,110**	**19,30,836**

CHAPTER IX
ENVIRONMENTAL COST BENEFIT ANALYSIS

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

CHAPTER X

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 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 Mr. B. Karuppaiah 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 programs 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.

10.1.1 Description of the Administration and Technical Setup

The environment monitoring cell discussed under chapter VI 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 program.
- ❖ 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 (unutilized 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 program. A detailed land environment management plan has been provided in Table 10.1.

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 & 100m 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 FAEs & EIA Coordinator

10.3 SOIL MANAGEMENT

No top soil will be removed and stored during the mining operation. Therefore, topsoil management plan is not provided here.

10.4 WATER MANAGEMENT

In the proposed quarrying project, no process is involved for the effluent generation, only oil & grease from the machinery wash and domestic sewage from mines office is anticipated. The quarrying operation is proposed up to a depth of 20 m. The water table in the area is at 60 m below ground level. Hence, the proposed project will not intersect the ground water table during entire quarry period. A detailed water environment management plan has been provided in Table 10.2.

Table 10.2 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 FAEs & EIA Coordinator

10.5 AIR QUALITY MANAGEMENT

The proposed quarrying activity would result in the increase of particulate matter concentrations in the ambient air. Daily water sprinkling on the haul roads, approach roads in the vicinity will 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. A detailed ambient air environment management plan is provided in Table 10.3.

Table 10.3 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 FAEs & 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. A detailed noise environment management plan has been provided in Table 10.4.

Table 10.4 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 is 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 FAEs & 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. A detailed ground vibration management plan has been provided in Table 10.5.

Table 10.5 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 FAEs & 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 program 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 and 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

The main objectives of the greenbelt development plan are to:

- Combat the dispersal of dust in the adjoining areas.
- Protect the erosion of the soil and conserve moisture of the soil.
- Increase the rate of recharge of ground water.
- 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. The proposed green belt development plan is given in Table 10.6.

Table 10.6 Proposed Greenbelt Development Plan

	No. of trees proposed for plantation	No. of trees expected to survive @ 80%	Area to be covered(m^2)
Plantation in the construction phase (3 months)	Number of plants inside the mine lease area		
	403	322	3627
	Number of plants outside the mine lease area		
	605	484	5441
Total	**1008**	**806**	**9068**

Source: Proposed by FAEs & EIA Coordinator

About 1008 saplings will be planted in and around the lease area with the survival rate of 80%. A well-planned green belt of trees with long canopy leaves shall be developed with dense plantations around the boundary and along the haul roads to prevent air, dust noise propagation to undesired places and efforts will be taken for the enhancement of survival rate.

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, Sperm Count 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 (Table 10.7) keep upgrading the database of medical history of the employees.

Table 10.7 Medical Examination Schedule

S. 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 color 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 centers. 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 Program

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 Centers 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, as shown in Table 10.8.

Table 10.8 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 and First aid Explosives
Task Training Like Drilling, Blasting, Stemming, safety, Slope	Employees assigned to new work tasks	Before new Assignments	Variable	✓ Task-specific health &safety procedures and SOP for various mining activity

stability, Dewatering, Haul Road maintenance.				✓ 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 on 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 FAEs & 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 10.9 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

Table 10.9 EMP Budget for Proposed Project

Attribute	Mitigation measures	Provision for Implementation	Capital Cost (Rs.)	Recurring Cost/annum (Rs.)
Air Environment	Compaction, gradation and drainage on both sides	Rental Dozer & drainage construction on haul road @ Rs. 10,000/- per hectare and yearly maintenance @ Rs. 10,000/- per hectare	20150	20150
	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
	Air quality will be regularly monitored as per norms within ML area & ambient area	Yearly compliance as per CPCB norms	0	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	75000	7500

	No overloading of trucks/tippers/tractors	Manual Monitoring through Security guard	0	5000
	Stone carrying trucks will be covered by tarpaulin to avoid escape of fines to the atmosphere	Monitoring if trucks will be covered by tarpaulin	0	10000
	Enforcing speed limits of 20 km/hr within ML area	Installation of Speed Governors @ Rs. 5000/- per tipper/dumper deployed	20000	0
	Regular monitoring of exhaust fumes as per RTO norms	Monitoring of Exhaust Fumes	0	5000
	Regular sweeping and maintenance of roads for at least about 200 m from quarry entrance	Provision for 2 labours @ Rs.10,000/labour (Contractual) / hectare	0	40300
	Installing wheel wash system near exit gate of quarry	Installation + Maintenance + Supervision	50000	20000
Noise Environment	Source of noise will be transportation vehicles, and 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 implementations 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 / Competent 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 tons of blasted material	0	437326

Water Environment	Water Management	Provision for garland drain @ Rs. 10,000/- per hectare with maintenance of Rs. 5,000/- per annum (2.91.5 ha X 10000)	20150	10075
Waste Management	Waste management (Spent Oil, Grease etc.,)	Provision for domestic waste collection and disposal through authorized agency(capital cost, recurring cost for collection /disposal).	25000	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
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	10000	1000
Occupational Health	Workers will be provided with Personal Protective Equipment	Provision of PPE @ Rs. 4000/- per employee with recurring based on wear and tear (say, @ Rs. 1000/- per employee)	76000	19000
and Safety	Health checkup for workers will be provisioned	IME & PME Health checkup @ Rs. 1000/- per employee	0	19000

	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	8060
	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 (2.91.5 hectare)	403000	20150
	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	100750	20150
	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

Development of Green Belt	Green belt development - 500 trees per hectare (200 Inside Lease Area & 300 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))"	80600	12090
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	181350	18135
Mine Closure	Closure includes 10% of the ammount alloted for Greenbelt development, wire fencing, and garland drainage (Rule 27 in MCDR 2017 for Cat B mines will pay 2 lakhs per hectare or minimum amount of financial assurance of 5 lakhs)		0	68510
	G.O.(Ms).No.23, Dated: 28.09.2021	Section IVA of TNMMCR 1959 (@10% of Seigniorage Fee) (Seigniorage Fee for Roughstone = Rs.59 and for Gravel= Rs.33)	1013454	0
TOTAL			**2970454**	**1588936 (Excel. Mine Closure)**

Table 10.10 Estimation of Overall EMP Budget after Adjusting 5% Annual Inflation

Ist Year	IInd Year	IIIrd Year	IVth Year	Vth Year (including Mine Closure Cost)	Total Recurring Cost	Total EMP Cost
1588936	1668383	1751802	1839393	1999872	8848387	11818840

In order to implement the environmental protection measures, an amount of **Rs.2970454** as Mine Closure cost and recurring cost as **Rs.1588936** as recurring cost/annum is proposed considering present market price considering present market scenario for the proposed project. After the adjustment of 5% inflation per year, the overall EMP cost for 5 years will be **Rs. 11818840** as shown in Table 10.10.

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.

CHAPTER XI

SUMMARY AND CONCLUSION

11.0 INTRODUCTION

This EIA report was prepared in compliance with ToR obtained vide Lr No. SEIAA-TN/F.No.9858/ToR-1441/2023.Dated 10.05.2023 by considering 4 proposed quarry, 3 existing quarry, and 2 expired quarries in a cluster with the total extent of 13.57.0 hectares in Katchaikatti Village, Vadipatti Taluk, Madurai District and Tamil Nadu State. Cluster area was calculated as per MoEF & CC Notification S.O. 2269 (E) Dated 1st July 2016. Baseline Monitoring studies were carried out during the period of March-May, 2023.

11.1 PROJECT DESCRIPTION

The proposed project deals with excavation of rough stone and gravel, which is primarily used, in construction projects. The method adopted for rough stone and gravel excavation is a manual open cast mining method involving formation of benches with 5 m height and 5 m width and secondary blasting. The proposed project area is located between latitudes from 10°4’47.79’’N to 10°4’55.37’’N and from longitudes from 78°0’37.99’’E to 78°0’44.65’’E in Katchaikatti Village, Vadipatti Taluk, Madurai District and Tamil Nadu. The project site is a Patta land with the extent of 2.01.5 ha leased for the project proponent, Thiru. B. Karuppaih. The proponent had applied for quarry lease on 28.02.2023 to extract rough stone and gravel obtained the precise area communication letter issued by Department of Geology and Mining, Madurai vide Rc.No.831/Mines/2022, dated:05.01.2023.. Based on the precise area communication letter, mining plan was prepared. The mining plan thus prepared was approved by Deputy Director of Geology and Mining, Madurai Roc.No.831/Mines/2022-2, dated:08.02.2023.

According to the approved mining plan, about 156188 m^3 of rough stone and 27862 m^3 gravel will be mined up to the depth of 20 m BGL in five years. To achieve the estimated production, 3 Jack Hammers, 1 compressor, 1 excavator with bucket/rock breaker, and 4 tippers will be deployed. To operate the machineries and to break the rough stone to preferred dimension, about 19 persons will be employed. At the end of the quarry life, the dimension of the ultimate pit will be 93 m*65 m*30 m and about 2.01.5 ha of land is unutilized. Whereas, at the end of the mine life, about 1.46.92 ha of land will have been quarried; about 0.42.11 ha of land will be used for green belt development and 0.02.0 will be used for road and 0.03.0 ha will be used for infrastructures.

The final mine closure plan shows that about **Rs.685100** capital cost with the annual recurring cost of **Rs.60450** will be spent towards mine closure.

11.2 DESCRIPTION OF THE ENVIRONMENT

The baseline monitoring studies were carried out during March-May, 2023 to assess the existing environmental conditions in the study area. For the purpose of the EIA studies, project area was considered as the core zone and area outside the project area up to 5 km radius from the periphery of the project site was considered as buffer zone. Baseline Environmental data has been collected for land, water, noise, ecology, socio-economy, and traffic density.

11.2.1 Land Environment

Land Use and Land Cover (LULC) map, as shown in Figure 3.3 was prepared using Sentinel II image for the study area of 5 km radius to provide a baseline status of the study area covering 5 km radius around the proposed mine site. Totally, 7 LULCs were mapped. The areal extent of each LULC is provided in Table 3.2. Of the total area, mining area covers only 70.80 ha accounting for 0.91 %, of which lease area of 2.01.5 ha contributes only about 0.026%. This small percentage of mining activities shall not have any significant impact on the land environment.

11.2.2 Soil Characteristics

Physical Characteristics

The soil samples in the study area show loamy textures varying between silty clay loam, silty loam and sandy loam. pH of the soil varies from 6.41 to 7.27 indicating slightly acidic to slightly alkaline nature. Electrical conductivity of the soil varies from 3.45 to 4.33 µs/cm. Bulk density ranges between 0.61to 0.99g/cm^3.

Chemical Characteristics

Nitrogen ranges between 1.57 and 2.13 %. Phosphate ranges between 2.03 and 3.64 %. Potassium ranges between 3.48 and 5.25 %. Calcium ranges between 1579 and 2516 mg/kg. Total carbon ranges between 23.7 and 31.5 %.

Soil Erosion

There is no soil erosion in the mining lease area. The south east and south west part of the lease area has less moderate soil erosion as shown in the soil erosion map in Figure 3.6

Soil Quality Assessment

Soil quality is the foundation of sustainable crop production. Soil quality assessment helps to understand soil conditions and adopt suitable production practices. It can be done using physical, chemical, and biological properties of soil. For this assessment, four soil quality parameters including pH, EC, OM, and BD were taken into account. The soil quality score for each sample has been provided in Table 3.4a.

11.2.3 Water Environment

Surface Water

Kuttalampatti waterfalls and Canal near in mine lease area are the two prominent surface water resources present in the study area. These are ephemeral in nature, which convey water only after rainfall events. The proposed project area is located 0.01 km N of Canal Near and 4.89 km NNW of Kuttalampatti waterfalls, as shown in Table 3.5 and Figure 3.5. Two surface water samples, known as SW1 and SW2 were collected from the two surface water bodies to assess the baseline water quality. Table 3.7 summarizes surface water quality data of the two samples. Result for surface water sample in the Table 3.7 indicate that the physical, chemical and biological parameters, and heavy metals are within permissible limits in comparison with standards of IS10500:2012.

Ground Water

Five groundwater samples, known as BW01, BW02, BW03, BW04 and OW01 collected from bore wells and open wells were analysed for physico-chemical conditions, heavy metals and bacteriological contents in order to assess baseline quality of ground water. Ground water sampling locations and their distance and direction from the lease area are provided in Table 3.5 and the spatial occurrence of water sampling locations is shown in Figure 3.7. Table 3.6 summarizes ground water quality data of the five samples.

Results for ground water samples in the Table 3.6 indicate that the physical, chemical and biological parameters, and heavy metals are within permissible limits in comparison with standards of IS10500:2012.

11.3 AIR ENVIRONMENT

Site Specific Meteorology

Site specific meteorology during the study period was recorded by an automated weather station. According to the onsite data, the temperature in March 2023 varied from 17.17 to 40.12^0 C with the average of 28.64^0 C; in April, 2023 from 23.94 to 41.31^0 C with the average of 30.69^0 C; and in May, 2023 from 23.12 to 36.43^0 C with the average of 28.70^0C. In March, 2023, relative humidity ranged from 18.88 to 98.81 % with the average of 60.17%; in April, 2023, from 18.44 to 96.0 % with the average of 57.14 %; and in May, 2023, from 39.06 to 97.00 % with the average of 75.28 %. The wind speed in March, 2023 varied from 0.10 to 6.48 m/s with the average of 3.02 m/s; in April, 2023 from 0.03 to 7.26 m/s with the average of 2.88 m/s; and in May, 2023 from 0.13 to 5.06 m/s with the average of 2.19 m/s. In March,2023, wind direction varied from 0.51 to 359.18^0 with the average of 114.77^0; in April, 2023, from 0.00 to 358.83^0 with the average of 139.92^0; and in May, 2023, from 3.38 to 359.69^0 with the

average of 226.68^0. In March,2023, surface pressure varied from 97.91 to 99.35 kPa with the average of 98.57 kPa; in April, 2023, from 97.66 to 99.01kPa with the average of 98.38 kPa; and in May, 2023, from 97.91 to 98.78 kPa with the average of 98.34 kPa**.**

Ambient Air Quality Results

As per the monitoring data, $PM_{2.5}$ ranges from 16.9 µg/m^3 to 21.1 µg/m^3; PM_{10} from 36.3 µg/m^3 to 40.2µg/m^3; SO_2 from 5.9 µg/m^3 to 8.2 µg/m^3; NO_X from 18.1 µg/m^3 to 22.0 g/m^3. The concentration levels of the pollutants fall within the acceptable limits of NAAQS prescribed by CPCB.

11.4 NOISE ENVIRONMENT

Ambient noise levels were measured at 7 locations around the proposed project area. Noise level in core zone was 41.6 dB (A) Leq during day time and 34.3 dB(A) Leq during night time. Noise levels recorded in buffer zone during day time varied from 39.2 to 47.5dB (A) Leq and during night time from 35.2 to 42.1 dB (A) Leq. Thus, the noise level for industrial and residential area meets the requirements of CPCB.

11.5 BIOLOGICAL ENVIRONMENT

Biological assessment of the site was done to identify ecologically sensitive areas and whether there are any rare, endangered, endemic or threatened (REET) species of flora & fauna in the core area as well its buffer zone to be impacted. The study has also been designed to suggest suitable mitigation measures, if necessary, for protection of wildlife habitats and conservation of REET species if any. The study found that there is no endemic, endangered migratory fauna found in the area. This area is not also a migratory path of any faunal species. Hence, this small mining operation over short period of time will not have any significant impact on the surrounding flora and fauna.

11.6 SOCIO-ECONOMIC ENVIRONMENT

The socio-economic study in the study area 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 a 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.

11.7 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES FOR PROPOSED PROJECT

The summary of anticipated adverse environmental impacts due to the proposed project and mitigation measures are given below:

Table 11.1 Anticipated Impacts & Mitigation Measures

Impact	Mitigation Measure
Land Environment	
❖ Destruction of natural landscapes ❖ Changes in soil characteristics ❖ Soil erosion and slope instability	❖ Mining will be carried out as per approved mine plan in scientific and systematic way ❖ Safety Zone or Buffer area will be maintained and will not be mined and instead plantation will be carried out in the safety zone ❖ Barbed wire fencing will be provided all along the proposed mine boundary ❖ At conceptual stage, the land use pattern of the quarry will be changed into Greenbelt area and temporary reservoir ❖ Construction of garland ❖ Construction of garland drains all around the quarry pit and construction of settling traps at strategic location in lower elevations to prevent soil erosion due to surface runoff during rainfall and also to collect the storm water for various uses within the proposed area
Water Environment	
❖ Decrease in aquifer recharge and increase in surface runoff; ❖ Disturbance to land drainage, overload and erosion of watercourses; ❖ Changes to the surface over which water flows; ❖ Changes to surface and groundwater resources quantity and quality due to stream blockage and	❖ Construction of garland drains all around the quarry pit and construction of settling traps at strategic location in lower elevations to prevent soil erosion due to surface runoff during rainfall and also to collect the storm water for various uses within the proposed area ❖ De-silting will be carried out before and immediately after the monsoon season and the settling tank and drains will be cleaned weekly, especially during monsoons ❖ Domestic sewage from site office & urinals/latrines provided in project area will be discharged through septic tank followed by soak pit system.

contamination by particulate matter or waste; ❖ Contamination of aquifers due to removal of the natural filter medium.	❖ Tippers & HEMM will be washed in a designated area and the washed water will be routed through drains to a settling tank, which has an oil & grease trap, only clear water will be reused for greenbelt development.
Air Environment	
❖ Generation of Fugitive Dust ❖ Dust will be generated mainly during excavation, loading &unloading activities. ❖ Gaseous pollutants will by generated mostly by the traffic. ❖ Reduction in visibility due to dust plumes. ❖ Coating of surfaces leading to annoyance and loss of amenity. ❖ Physical and/or chemical contamination and corrosion. ❖ Increase in the concentration of suspended particles in runoff water. ❖ Coating of vegetation leading to reduced photosynthesis, ❖ Inhibited growth, destroying of foliage, degradation of crops;	❖ Haul roads will be well maintained by sprinkling water twice a day ❖ The access road will be cleaned and brushed to ensure that mud and dust deposits do not accumulate. ❖ To ensure that dust and debris is minimised on the access road, all the tipper drivers will be instructed to use water spray system on all the tyres and spray water on the loaded material that is provided at the compound area before leaving the site ❖ Speed restrictions will be imposed to avoid spillage of loaded materials upon the road and to reduce wear and tear of the road. ❖ Weekly inspections of the condition of the access road by competent person employed, and immediate action will be taken to address any potholes or damage to the road surface. ❖ Dust wetting agents can be mixed with the water applied to haul roads during hot, dry weather conditions to increase the duration that the road surface remains damp. ❖ Personal Protective Equipment's will be provided to all workers ❖ All drilling rods used will have dust suppression systems fitted which injects water into the hole. ❖ Wet gunny bags will be used as a cover while drilling.

❖ Increase in health hazards due to inhalation of dust.	❖ The blast zone will be kept damp by the application of water from the rain gun fitted to the water tanker prior to each blast to control any fugitive dust emissions that could arise from the surface during detonation. ❖ A daily visual inspection shall be conducted by the site manager who will keep a daily log of all process operations and site activities and note any malfunctions which could lead to abnormal emissions from the quarry operations. ❖ A site speed limit of 20 km/h will be set to minimise the potential for dust generation ❖ Weekly maintenance programme to identify machinery due for maintenance, based on the number of hours it has been in operation. ❖ Air filters are renewed after every 10°0 hours of use, unless otherwise indicated by an on-board computer system. ❖ All site machineries & tippers will be serviced and maintained 6 months once and drivers will report any defects immediately to the site manager to enable repairs to be carried out promptly.
Noise & Vibration	
❖ Annoyance and deterioration of the quality of life; ❖ Propelling of rocks fragments by blasting. ❖ Shaking of buildings and people due to blasting;	❖ 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.
Biological Environment	
❖ Direct impacts include land clearance and excavation causing destruction of flora and fauna and loss of habitats; ❖ Indirect impacts include habitat degradation due to noise, dust, and human activity.	❖ Only some common herbs, shrubs and grass will be cleared. So, there will be no impact on the biodiversity. ❖ Green belt development with suitable species will enhance the biodiversity of the project area. ❖ The core zone or buffer zone does not encompass any threatened flora or fauna species.

Socio-Economic Environment	
❖ Health and safety of workers and the general public; ❖ Increase in traffic volumes and sizes of road vehicles; ❖ Economic issues, including the increase in employment opportunities;	❖ The mining activity puts negligible change in the socio-economic profile. ❖ Around 88 local workers will get employment opportunities along with periodical training to generate local skills. ❖ New patterns of indirect employment/ income will generate. ❖ Regular health check-up camp. ❖ Assistance to schools and scholarship to children will be provided.
Occupational Health & Safety	
❖ Exposure to Dust ❖ Noise and Vibration Exposure ❖ Physical Hazards ❖ Respiratory hazards due to Dust exposure	❖ Provision of rest shelters for mine workers with amenities like drinking water etc. ❖ All safety measures like use of safety appliances, such as dust masks, helmets, shoes, safety awareness programs, awards, posters, slogans related to safety etc. ❖ Training of employees for use of safety appliances and first aid in vocational training centre. ❖ Weekly maintenance and testing of all equipment as per manufacturers' guidelines. ❖ Pre placement and Yearly Medical Examination of all workers by a medical Officer ❖ First Aid facility will be provided at the mine site. ❖ Close surveillance of the factors in working environment and work practices which may affect environment and worker's health by the mine's manager employed. ❖ Working of mine as per approved mining plan and environmental plans

11.8 ANALYSIS OF ALTERNATIVES

There are no alternatives suggested as the proposed mining area has the following advantages:

- The mineral deposit occurs in a non-forest area.
- There is no habitation within the applied lease area; hence no R & R issues exist.
- There is no river, stream, nallas and water bodies in the or passing through 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 accessible.
- Mine connectivity through road and rail is good.
- The proposed mining operations do not intersect the ground water level. Hence, no impact on ground water environment.

11.9 ENVIRONMENTAL MONITORING PROGRAM

Environmental Monitoring program will be conducted for various environmental components such as air quality, meteorology, water quality, water level monitoring, soil quality, noise level, vibration, and greenbelt as per conditions stipulated in Environmental Clearance Letter issued by SEIAA & Consent to Operate issued by TNPCB. For this environmental monitoring program, Rs **2,95,000** /- per annum will spent by the project proponent. 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 and 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.

11.10 ADDITIONAL STUDIES

Public Consultation for proposed project

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.

Risk Analysis & Disaster Management Plan for proposed project

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, and 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 time table are recorded along with pinpointed responsibilities.

In the unlikely event that a consequence has occurred, disaster management kicks in. This includes instituting procedures pertaining to a number of issues such as communication, rescue, and rehabilitation. These are addressed in the disaster management plan. Both, the RA and DMP, are living documents and need to be updated whenever there are changes in operations, equipment, or procedures Assessment is all about preventing accidents and taking necessary steps to prevent it from happening.

The Disaster Management Plan (DMP) is a guide, giving general considerations, directions, and procedures for handling emergencies likely to arise from planned operations. The DMP has been prepared on the basis of the Risk Assessment and related findings covered in the report.

Cumulative Studies

- The results on the cumulative impact of the four proposed projects on air environment of the cluster do not exceed the permissible limits set by CPCB for air pollutants.
- The cumulative results of noise for the habitation in consideration do not exceed the limit set by CPCB for residential areas for day time.
- PPV resulting from four proposed projects is well below the permissible limit of Peak Particle Velocity of 8 mm/s.
- The one proposed project will allocate Rs. 500000/- towards CER as recommended by SEAC.
- The four proposed project will directly provide jobs to 79 local people, in addition to indirect jobs.
- The four proposed project will plant 3671 about trees in and around the lease area.
- The four proposed project will add 315 PCU per day to the nearby roads.

11.11 PROJECT BENEFITS FOR PROPOSED PROJECT

Various benefits are envisaged due to the proposed mine and benefits anticipated from the proposed project to the locality, neighbourhood, region and nation as a whole are:

- Direct employment to 19 local people and indirect employment to the people
- Rain water harvesting structures to augment the water availability for irrigation and plantation and ground water recharge
- Creation of community assets (infrastructure) like school buildings, village roads/ linked roads, dispensary & health Centre, community Centre, market place etc.,
- Strengthening of existing community facilities through the Community Development Programme
- Skill development & capacity building like vocational training
- Awareness program and community activities, like health camps, medical aids, sports & cultural activities, plantation etc.,
- CSR activities mainly contributing to education, health, training of women self-help groups and infrastructure etc., will be taken up in the Katchaikatti Village. CSR budget is allocated as 2.5% of the profit.
- Rs. 5,00,000 will be allocated for CER.

11.12 ENVIRONMENT MANAGEMENT PLAN

In order to implement the environmental protection measures, an amount of **Rs.2970454** as capital cost and recurring cost as Rs. **1588936** as recurring cost/annum is proposed considering present market price considering present market scenario for the proposed project. After the adjustment of 5% inflation per year, the overall EMP cost for 5 years will be **Rs.11818840.**

11.13 CONCLUSION

EIA study was performed as per the approved ToR. Various environmental attributes were studied relating with aspects of mining activities. The related impacts were identified and evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and accordingly fund was allocated. The EMP has been dynamic, flexible and subject to periodic review. CER activities were identified and for its time bound implementation, fund has been allocated.

The project will increase the revenue of the State Govt. as well as it will help in the social upliftment of the local community. The green belt development programme will help in increasing the green cover in the area. Thus, the proposed project is not likely to affect the environment or adjacent ecosystem in an adverse way.

The Mines Management will be responsible for the project 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.

CHAPTER XII

DISCLOSURES OF CONSULTANT

The Project Proponent, **Mr.B.Karuppaiah** has engaged **Geo Technical Mining Solutions**, a NABET accredited consultancy for carrying out the EIA study as per the ToR issued.

Address of the consultancy:

No: 1/213B Natesan Complex,
Oddapatti, Dharmapuri – 636705,
Tamil Nadu, India.
Email:info.gtmsdpi@gmail.com
Web: www.gtmsind.com
Phone: 04342 232777.

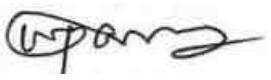
The accredited experts and associated members who were engaged in this EIA study are given below:

S.No	Name of the expert	In house/ Empanelled	Sector	Functional Area	Category
Approved Functional Area Experts & EC					
1.	Dr. S. Karuppannan	EIA Coordinator (EC) In-house	1(a)(i)	Mining	B
2.	Dr. M. Vijayprabhu	In-house FAE	1(a)(i)	HG, LU, GEO	B
3.	Dr. J. Rajarajeswari	In-house, FAE	1(a)(i)	EB, SC	B
4.	Dr. G. Prabakaran	In-house, FAE	1(a)(i)	SE	B
5.	Dr. R. Arunbalaji	In-house, FAE	1(a)(i)	AP, AQ, NV	B
6.	J.N. Manikandan	Empanelled FAE	1(a)(i)	RH, SHW, AP	B
7.	Dr. S. Malar	In-house, FAE	1(a)(i)	WP	B
8.	G. Umamaheswaran	In-house, FAE	1(a)(i)	HG, LU, GEO	B
9.	S. Gopalakrishnan	In-house, FAE	1(a)(i)	HG, GEO	B
10.	P. Venkatesh	In-house, FAE	1(a)(i)	AP	B
11.	Dr. D.Kalaimurugan	In-house, FAE	1(a)(i)	SC	B
Approved Functional Area Associates					
12.	G. Prithiviraj	FAA	1(a)(i)	LU, HG	B
13.	C. Kumaresan	FAA	1(a)(i)	NV	B
14.	P. Vellaiyan	FAA	1(a)(i)	HG, GEO	B
15.	P. Dhatchayini	FAA	1(a)(i)	AQ	B
16.	V. Malavika	FAA	1(a)(i)	NV, SHW	B

Abbreviations			
EC	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 modelling, and prediction	HW	Hazardous Wastes
EB	Ecology and bio-diversity	GIS	Geographical Information System

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA & EMP

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

Signature : 

Date : 20.06.2023

Name : **Dr. S. Karuppannan**

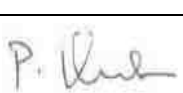
Designation : EIA Coordinator

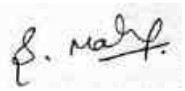
Name of the EIA Consultant Organization : Geo Technical Mining Solutions

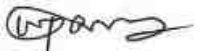
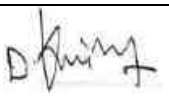
Period of Involvement : Till date

We, the FAEs and FAAs hereby declare that information furnished in this EIA/EMP report for **Thiru.B.Karuppaiah** rough stone and gravel quarry project with the extent of 2.01.5 ha situated in the cluster with the extent of **13.57.0** ha in Katchaikatti Village of Vadipatti Taluk, Madurai District of Tamil Nadu is true and correct to the best of our knowledge.

List of Functional Area Experts Engaged in this Project

S. No.	Functional Area	Involvement	Name of the Experts	Signature
1	AP	o Identification of different sources of air pollution due to the proposed mine activity o Prediction of air pollution and propose mitigation measures / control measures	J.N. Manikandan	
			P.Venkatesh	

2	WP	o Suggesting water treatment systems, drainage facilities o Evaluating probable impacts of effluent/waste water discharges into the receiving environment/water bodies and suggesting control measures.	Dr.S. Malar	
3	HG	o Interpretation of ground water table and predict impact and propose mitigation measures. o Analysis and description of aquifer Characteristics	Dr.M. Vijay Prabhu	
			G. Uma Maheswaran	
			Dr.S. Karuppannan	
4	GEO	o Field Survey for assessing the regional and local geology of the area. o Preparation of mineral and geological maps. o Geology and Geo morphological analysis/description and Stratigraphy/Lithology.	G.Gopala Krishnan	
			G.Uma Maheswaran	
			Dr.M. Vijay Prabhu	
			Dr.S. Karuppannan	
5	SE	o Revision in secondary data as per Census of India, 2011. o Impact Assessment & Preventive Management Plan o Corporate Environment Responsibility.	Dr. G. Prabhakaran	
6	EB	o Collection of Baseline data of Flora and Fauna. o Identification of species labelled as Rare, Endangered and threatened as per IUCN list. o Impact of the project on flora and fauna. o Suggesting species for greenbeft development.	Dr.J. Rajarajeshwari	
7	RH	o Identification of hazards and hazardous substances o Risks and consequences analysis	J.N. Manikandan	

		○ Vulnerability assessment ○ Preparation of Emergency Preparedness Plan ○ Management plan for safety.		
8	LU	○ Construction of Land use Map ○ Impact of project on surrounding land use ○ Suggesting post closure sustainable land use and mitigative measures.	Dr.S. Karuppannan	
			G.Uma Maheswaran	
			Dr.M. Vijay Prabhu	
9	NV	○ Identify impacts due to noise and vibrations ○ Suggesting appropriate mitigation measures for EMP.	Dr.R. Arun Balaji	
10	AQ	○ Identifying different source of emissions and propose predictions of incremental GLC using AERMOD. ○ Recommending mitigations measures for EMP	Dr.R. Arun Balaji	
11	SC	○ Assessing the impact on soil environment and proposed mitigation measures for soil conservation	Dr.J. Rajarajeshwari	
			Dr. D.Kalaimurugan	
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.	J.N. Manikandan	

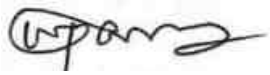
List of Functional Area Associate Engaged in this Project

S.No.	Name	Functional Area	Involvement	Signature
1	G. Prithiviraj	LU, HG	○ Site visit with FAE ○ Provide inputs & Assisting FAE for LU and HG	
2	C. Kumaresan	NV	○ Assistance to FAE in both primary and secondary data collection	

			○ Assistance in noise prediction modelling	
3	P. Vellaiyan	HG & GEO	○ Field visits along with FAE ○ Assistance to FAE in both primary and secondary data collection	
4	P. Dhatchayini	AQ	○ Site visit with FAE ○ Assistance to FAE in collection of both primary and secondary data	
5	V. Malavika	NV, SHW	○ Site visit along with FAE ○ Assistance in report preparation	

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, **Dr. S. KARUPPANNAN,** Managing Partner, **Geo Technical Mining Solutions**, hereby, confirm that the above-mentioned functional area experts and team members prepared the EIA/EMP report for **Thiru. B. Karuppaiah** rough stone and gravel quarry project with the extent of 2.01.5 ha located within the cluster of 13.57.0 ha in Katchaikatti Village of Vadipatti Taluk, Madurai District of Tamil Nadu is true and correct to the best of my knowledge.

Signature	:	
Date	:	20.06.2023
Name	:	**Dr. S. Karuppannan**
Designation	:	Managing Partner
Name of the EIA Consultant Organization	:	Geo Technical Mining Solutions
NABET Certificate No & Issue Date	:	NABET/EIA/2023/IA0067 &March 30,2021
Validity	:	Till 29.12.2023