

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

&

ENVIRONMENT MANAGEMENT PLAN

FOR OBTAINING

Environmental Clearance under EIA Notification - 2006

Schedule SI. No. 1 (a) (i): Mining Project

**"B1" CATEGORY - MINOR MINERAL - CLUSTER -PATTA LAND -
EXISTING QUARRY**

THIRU. R. HARIHARASUDHAN ROUGH STONE AND GRAVEL QUARRY

Cluster Extent - 16.30.50 Ha

Project Proponent

Thiru. R. Hariharasudhan,
S/o. Raja,
No. 27, Guru Bhagavan Illam,
Star Nagar 5th Street,
P and T Nagar Anaiyur,
Madurai North Taluk,
Madurai District - 625 017
Mining period - 5 Years

PROJECT LOCATION	PROPOSED PRODUCTION
S.F. Nos. 3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6 Extent: 3.59.0Ha Sundakkottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State	Reserves = 7,40,985m³ of rough stone 50,060 m ³ of Gravel Peak Production = 1,93,070m³ of rough stone Proposed Depth =57m BGL (2m gravel + 55m Rough Stone)
ToR obtained vide File No: 12955 ToR Identification No: TO25B0108TN5934988N Dated: 29.12.2025	
Environmental Consultant GEO EXPLORATION AND MINING SOLUTIONS Old No. 260-B, New No. 17, Advaitha Ashram Road, Alagapuram, Salem - 636 004, Tamil Nadu, India Accredited for sector 1 Cat 'A', sector 31 & 38 Cat 'B' Certificate No : NABET/EIA/25-28/RA 0424 Valid Till: 06.08.2028 Phone: 0427-2431989, Email: ifthiahmed@gmail.com, geothangam@gmail.com Web: www.gemssalem.com	Laboratory CHENNAI METTEX LAB PRIVATE LIMITED (Approved by AAI, AGMARK, APEDA, BIS, EIC FSSAI, GAFTA, IOPEPC, MOEF & TEA BOARD) Jothi Complex, 83, M.K.N Road, Guindy, Chennai - 600 032
Baseline Monitoring Period OCTOBER to DECEMBER 2025 APRIL - 2026	

UNDERTAKING

I Thiru. R. Hariharasudhan given undertaking that this EIA & EMP report prepared for our Rough Stone and Gravel quarry situated in S.F.Nos. 3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6 of Sundakkottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State based on the ToR issued by the State Level Environmental Impact Assessment Authority (SEIAA), Tamil Nadu vide File No: 12955 ToR Identification No: TO25B0108TN5934988N Dated: 29.12.2025.

I hereby assured that the Data's submitted and information given by me is true and correct to the best of my knowledge.

Signature of the Project Proponent



R. Hariharasudhan

Place: Virudhunagar

Dated:

DECLARATION

I Dr. M. Ifthikhar Ahmed – EIA Co Ordinator declare that this EIA & EMP report for the Rough stone and Gravel quarry in S.F.Nos. 3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6 of Sundakkottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State has been prepared by Geo Exploration and Mining Solutions, Salem, Tamil Nadu.

The Data's provided in the EIA report are true and correct to the best of my knowledge.

Signature of the EIA Co Ordinator



Dr. M. Ifthikhar Ahmed

Managing Partner

M/s. Geo Exploration and Mining Solutions

Place: Salem

Dated:

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

CODE	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
PROPOSED QUARRY					
P1	Thiru. R. Hariharasudhan, S/o. Raja, No. 27, Guru Bhagavan Illam, Star Nagar 5 th Street, P and T Nagar Anaiyur, Madurai North Taluk, Madurai District – 625 017	Sundakkottai	3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6	3.59.0 Ha	File No. 12955 ToR Identification No: TO25B0108TN59349- 88N Dated: 29.12.2025
TOTAL EXTENT				3.59.0 Ha	
EXISTING QUARRY					
E-1	Thiru.S.Subbareddiar S/o, Kasthuri Reddiar 99, Keelakaranthai Kamatchi Chettiyar Street, South Street, Aruppukottai Taluk	Sundakkottai	46/1,46/2,46/3,46/4	1.29.50Ha	KV1/245/2020 Dated.22.05.2023
E-2	Thiru.T.R.Varadha Rajan 1, Ramasamy Nayakkar Street, Aruppukottai		48/12,48/13,48/14,50/ 2,50/3 (P) 50/4,50/5,50/6,50/11	2.22.50 Ha	KV1/737/2018 12.05.2022
E-3	Thiru. K.Bharathiraja S/o, Krishnan 78/M-33, Ajeesh Nagar, Thenvaldal Street, Aruppukottai Town and Taluk		26/6A,26/6B,26/C,26/ 7,26/2A	0.80.50Ha	KV1/537/2019 Dated: 16.11.2021
E-4	Tmt.T.Muthulakshmi w/o Tamilselven 65/12/338, Kamaraj Nagar 2 nd Street, Paramakudy Ramanadhapuram District		100/6B,100/7,100/8,1 00/9,100/10,100/11	1.96.00 Ha	KV1/75/2021 Dated.13.04.2023
E-5	Thiru.K.Balamurugan		104/1A,104/1B1,104/ 1B2,104/2A,104/2B,1 04/3,104/4A1,104/4A 2,104/4B,104/4C,104/ 5A,104/5B,104/6A,10 4/6B,104/7A,104/7B, 104/8A,104/8B,104/8 C,104/8D,104/8E	3.02.50 Ha	KV1/030/2021 Dated.14.02.2025
E-6	Thiru.m.Thiruvappu S/o Muniasamy Devakurutchi Village Kadaladi Taluk, Ramanathapuram District.		64/3A,64/3B,64/3D,6 5/2A,65/2B,65/3A,65/ 6,66/1A1,66/1A2,66/1 B2,66/2A2,66/2B1,66 /2B2,67/3A1,65/3B1, 66/3B2,67/3A1,65/3B 1,66/3B2,66/1B1,66/2 A1,64/1B1,66/2A1,64 /6A,64/7A,64/6B,64/7 B	3.40.50	KV1/666/2020 06.06.2023
TOTAL CLUSTER EXTENT				12.71.5 Ha	
ABANDONED / EXPIRED QUARRY					
EXP-1	Thiru.P.Tamilselvam S/o Ramar 8/126, Madurai, Rameshwaram Road, Paramakudi, Ramanathapuram Taluk.		3/8,3/9,3/10,3/11,3/12 A,3/12b, 3/12c,3/12d, 4/2,4/3,4/4A,4/4b,4/5, 4/6	3.59.0 Ha	25VNR0402658
TOTAL EXTENT				3.59.0 Ha	
TOTAL CLUSTER EXTENT				16.30.5 Ha	

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

TERMS OF REFERENCE (ToR) COMPLIANCE**File No: 12955****ToR Identification No:TO25B0108TN5934988N Dated: 29.12.2025**

SEAC CONDITIONS – SITE SPECIFIC MAJOR CONDITIONS		
1.1	1.The Project Proponent shall incorporate the details about existing pit as mentioned in the approved mining plan, obtained from the Assistant Director, Mines, Virudhunagar District	Noted & agreed. We have obtained the Existing Pit dimensions along with the 500m Letter vide Lr.No.Roc.No.25VNR0402658 Dated.07.10.2025
	2.The Project Proponent shall install sheet fencing and develop 3-tier plantation as mitigation measures to protect the farm house located at a distance of 27 meters in the southern direction.	Noted & agreed. We have erected the Barbed wire fencing along the boundary and we have carried out the green belt activities around the project site.
SEAC CONDITIONS – OTHER SITE SPECIFIC		
2.1	A Cluster Management Committee (CMC) shall be constituted including all the mines in the cluster as Committee Members for the effective management of the mining operation in the cluster through systematic & scientific approach with appointment of statutory personnel, appropriate environmental monitoring, good maintenance of haul roads and village/panchayat roads, authorized blasting operation etc. The PP shall submit the following details in the form of an Affidavit during the EIA appraisal: i) Copy of the agreement forming CMC. ii) The Organization chart of the Committee with defining the role of the members iii)The 'Standard Operating Procedures' (SoP) executing the planned activities	Noted & agreed A Cluster Management Committee (CMC) was detailed in chapter 7
	2. The Boundary pillars to be erected as per the mine rules and the evidence should be submitted along with the EIA report.	Noted & agreed The PP erected DGPS pillars as per MCDR Rules, 1988 and photograph is enclosed in chapter 2,
	3. The details of enumeration of structures including schools, colleges, primary health centers should be submitted along with the EIA report.	Noted and agreed.
	4. The structures within the radius of (i) 50 m, (ii) 100 m, (iii) 200 m and (iv) 300 m & up to 1km 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. and spell out the mitigation measures to be proposed for the protection of the above structures, if any during the quarrying operations.	Noted and agreed.
	5. The proponent shall furnish photographs of adequate fencing; garland drainage built with siltation tank & green belt along the periphery including replantation of existing trees; maintaining the safety distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan.	Noted & agreed Fencing, garland drainage & green belt photographs are enclosed in chapter 2. There are no trees in inside lease area.
	6. The Proponent shall carry out Bio diversity study as a part of EIA study and the same shall be included in the Report	Noted and agreed The Bio diversity study has been conducted by the Functional Area Expert approved by the NABET. The same has been detailed in the Chapter No. 3,
	7. The PP shall prepare the EMP for the entire life of mine and also furnish the sworn affidavit	Noted and Agreed

	stating to abide the EMP for the entire life of mine	Details are discussed in chapter no 10, Table no 10.9, and the sworn affidavit will be submitted after obtaining Environmental Clearance.
	8. The PP shall carry out the comprehensive studies on the cumulative environmental impacts of the existing & proposed quarries which included drilling & blasting, loading & hauling on the surrounding village and structures.	Noted and agreed.
	9. The PP shall prepare a conceptual action plan accommodating the inclusion of haul road accessibility keeping the benches intact, by ensuring the slope stability of the working benches to be constructed and existing quarry wall.	Noted and agreed.
	10. The PP shall install the CCTV camera for the continuous surveillance of mining activity & furnish the photographic/video graphic evidence along with the EIA report.	Noted & agreed The CCTV camera photographs will be submitted along with Final EIA Report.
SEAC STANDARD CONDITIONS		
3.1	1. In the case of existing/operating mines, a letter obtained from the concerned AD (Mines) shall be submitted and it shall include the following: (i) Original pit dimension (ii) Quantity achieved Vs EC Approved Quantity (iii) Balance Quantity as per Mineable Reserve calculated. (iv) Mined out Depth as on date Vs EC Permitted depth (v) Details of illegal/illicit mining (vi) Violation in the quarry during the past working. (vii) Quantity of material mined out outside the mine lease area (viii) Condition of Safety zone/benches (ix) Revised/Modified Mining Plan showing the benches of not exceeding 6 m height and ultimate depth of not exceeding 50m.	Noted & agreed It is a Fresh lease application, Previous operation details were not found, and the Existing Pit Details depth was about 6m.
	2. Details of habitations around the proposed mining area and latest VAO certificate regarding the location of habitations within 300m radius from the periphery of the site.	Noted and Agreed Project Proponent obtained VAO certificate and there is no approved habitation within the radius of 300m & enclosed in Annexure.
	3. The proponent is requested to carry out a survey and enumerate on the structures located within the radius of (i) 50 m, (ii) 100 m, (iii) 200 m and (iv) 300 m (v) 500m 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 with indicating the owner of the building, nature of construction, age of the building, number of residents, their profession and income, etc.	Noted & agreed The enumeration of structure detailed in chapter 3 in Socio Economic Environment, Page No. 94.
	4. The PP shall submit a detailed hydrological report indicating the impact of proposed quarrying operations on the waterbodies like lake, water tanks, etc are located within 1 km of the proposed quarry.	Noted and agreed. The Hydrogeological study has been carried out in the project site considering the water bodies located within the radius of 1km. The hydrogeological study (Resistivity survey) is detailed in the EIA report, Chapter No.3
	5. The Proponent shall carry out Bio diversity study through reputed Institution and the same shall be included in EIA Report.	Noted and agreed The Bio diversity study has been conducted by the Functional Area Expert approved by the NABET. The same has been detailed in the Chapter No. 3
	6. The DFO letter stating that the proximity distance of Reserve Forests, Protected Areas, Sanctuaries,	Noted and agreed

Tiger reserve etc., up to a radius of 25 km from the proposed site.	Nearest Reserve Forest: Vidathakulam R.F -15.3km-NE
7. 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 the PP shall carry out the scientific studies to assess the slope stability of the working benches to be constructed and existing quarry wall, by involving any one of the reputed Research and Academic Institutions - CSIR-Central Institute of Mining & Fuel Research / Dhanbad, NIRM/Bangalore, Division of Geotechnical Engineering-IIT-Madras, NIT-Dept of Mining Engg, Surathkal, and Anna University Chennai-CEG Campus. The PP shall submit a copy of the aforesaid report indicating the stability status of the quarry wall and possible mitigation measures during the time of appraisal for obtaining the EC.	Noted and agreed. It is an Existing quarry. The Small area of excavation was carried out very older and the depth was about 6m. For this mining plan period it is proposed 57m bgl. The slope stability study will be carried out after commencement of the mining operation or when the mine reaches 30m depth.
8. However, in case of the fresh/virgin quarries, the Proponent shall submit a conceptual 'Slope Stability Plan' for the proposed quarry during the appraisal while obtaining the EC, when the depth of the working is extended beyond 30 m below ground level	Noted and Agreed It is an Existing quarry the Previous operation was carried out on older and the depth was about 6m. For this mining plan period it is proposed 57m bgl. The slope stability study will be carried out after commencement of the mining operation or when the mine reaches 30m depth.
9. 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.	Noted and agreed Proponent given under taking that the blasting will be carried out by the statutory person as per the MMR 1961.
10. 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.	Noted and agreed Chapter-2 sub - 2.5.1Drilling & Blasting Parameters NONEL initiation based controlled blasting operation involving line drilling and muffle blasting in the proposed quarry Chapter-4, Sub 4.4.2 Common Mitigation Measures for Respective Individual Proposed Projects The blasting will be carried out during favorable atmospheric condition and less human activity timings by using nonelectrical initiation system
11. 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.	Noted and Agreed
12. 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,	
13. What was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines?	
14. Quantity of minerals mined out. · Highest production achieved in any one year · Detail of approved depth of mining · Actual depth of the mining achieved earlier. · Name of the person already mined in that leases area. · If EC and CTO already obtained, the copy of the same shall be submitted.	

Whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches.	
15. All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/Topo sheet, topographic sheet, geomorphology, lithology and geology of the mining lease area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Project area boundary coordinates superimposed on Toposheet Chapter-1, Figure. No. 1.3, Page No. 6. Surface Features around the project area covering 10km radius Chapter-2, Figure. No. 2.5, Page No. 17. Geology map of the project area covering 10km radius Chapter-2, Figure. No. 2.8, Page No. 19. Geomorphology Map of the Study Area covering 10 km radius Chapter-2, Figure. No. 2.9, Page No. 24.
16. The PP shall carry out Drone video survey covering the cluster, green belt, fencing, etc.,	Noted & agreed It will be submitted on final EIA appraisal.
17. The proponent shall furnish photographs of adequate fencing, green belt along the periphery including replantation of existing trees & safety distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan.	Noted & agreed Fencing, garland drainage & green belt photographs are enclosed in chapter 2. There are no trees in inside lease area.
18. 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 remedial measures for the same.	Noted and Agreed Details of Geological Resources and Proposed reserves are discussed under Chapter No. 2
19. 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 the Mines Act 1952 and the MMR, 1961 for carrying out the quarrying operations scientifically and systematically in order to ensure safety and to protect the environment.	Noted and agreed Organization chart for the Competent persons to be appointed as per the provisions of the Mines Act 1952 is given in the Chapter No.6
20. The Project Proponent shall conduct the hydro-geological study considering the contour map of the water table detailing the number of groundwater pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds, etc. within 1 km (radius) along with the collected water level data for both monsoon and non-monsoon seasons from the PWD / TWAD so as to assess the impacts on the wells due to mining activity. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided.	Noted and agreed The hydro-geological study was conducted to evaluate the possible impact on the ground water table. No significant impacts are anticipated on the water bodies around the project area. Details are discussed under Chapter No. 3.
21. The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quality, air quality, soil quality & flora/fauna including traffic/vehicular movement study.	Noted and agreed Baseline Data were collected for pre-monsoon season October 2025 – December 2025 Details in Chapter No. 3, Page No. 34.
22. 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.	Noted and agreed The Cumulative impact study due to mining operations are detailed in chapter 7, Page no. 135.

23. Rain water harvesting management with recharging details along with water balance (both monsoon & non-monsoon) be submitted.	Noted and agreed The lower part of the mine pit will act as temporary rainwater harvesting structure, besides Rainwater harvesting structure will be constructed near the mine office and labour shed after commencement of mining operation.
24. Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use and land cover of the study area is discussed in Chapter No. 3, Page no. 104. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3, Page no.: 20
25. 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 There is no waste anticipated in this Rough Stone and gravel quarrying operation. The entire quarried out materials will be utilized (100%).
26. 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. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.
27. 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.	Noted and agreed The lower part of the mine pit will be utilized as rain water harvesting structure (Temporary) and the water will be used for the water sprinkling on-haul roads and Greenbelt development purpose. Rainwater harvesting structure will be constructed near the mine office.
28. Impact on local transport infrastructure due to the Project should be indicated.	Noted and agreed 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 Chapter No.2, Page No. 30.
29. A tree survey study shall be carried out (nos., name of the species, age, diameter etc.,) both within the mining lease applied area & 300m buffer zone and its management during mining activity.	Noted and agreed It was proposed 1750 Nos of trees were planted as a part of greenbelt development programme all along the periphery of the lease applied area and approach roads and village roads.
30. A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific.	Noted and agreed After the completion of mining operation, the quarried-out land will be utilized as temporary storage reservoir. The details are given in the Chapter No.4
31. 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.	Noted and Agreed

32. 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. 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.	Noted and agreed The varieties of plantations have been proposed as per the Appendix given in the ToR. It is a Proposed Lease. Around 1750 trees are proposed to plant in the boundary area and in the village roads.
33. Taller/one year old Saplings raised in appropriate size of bags; preferably ecofriendly bags should be planted as per the advice of local forest authorities/botanist/Horticulturist with regard to site specific choices. The proponent shall earmark the greenbelt area with GPS coordinates all along the boundary of the project site with at least 3 meters wide and in between blocks in an organized manner	Noted and Agreed
34. 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.	Noted and Agreed Disaster management Plan details in Chapter-7, Page No.133.
35. 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.	Noted and Agreed A Risk Assessment and management Plan Chapter-7, Page No.131.
36. 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.	Noted and Agreed Occupational Health impacts are given in the Chapter- 10, Page No.159.
37. 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.	Noted and agreed. No Public Health Implications anticipated due to this project.
38. The Socio-economic studies should be carried out within a 5 km buffer zone from the mining activity. Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Noted and Agreed Details explained Socio economic and impacts studies regarding Chapter No. 3, Page no. 121.
39. Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given	Noted and Agreed No Litigation is pending against the project.
40. 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.	Noted and agreed The benefits of the project are given in the Chapter No 8. • Through this project around 1750 Nos of trees will be planted • The government will get revenue from the way of Seigniorage fee, royalty etc., Around 34 people will get direct employment through this project.
41. If any quarrying operations were carried out in the proposed quarrying site for which now the EC is sought, the Project Proponent shall furnish the detailed compliance to EC conditions given in the	Noted and Agreed

	previous EC with the site photographs which shall duly be certified by MoEF&CC, Regional Office, Chennai (or) the concerned DEE/TNPCC.	
	42. The PP shall prepare the EMP for the entire life of mine and also furnish the sworn affidavit stating to abide the EMP for the entire life of mine	Noted and Agreed Details are discussed in chapter no 10, Table no 10.9, Page no. 153.
	43. Concealing any factual information or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this Terms of Conditions besides attracting penal provisions in the Environment (Protection) Act, 1986.	Noted and Agreed
SEIAA STANDARD CONDITION		
Cluster Management Committee		
1	Cluster Management Committee, which must include all the proponents in the cluster as members including the existing as well as proposed quarry.	Noted and agreed Cluster management committee detailed in chapter 7, page no. 144. Cluster management committee has been formed with mutual agreement with the proponents including Proposed quarry at present are framed.
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.	Noted and agreed. As per the committee agreement proponents will coordinates for the Greenbelt development, Water sprinkling and tree plantation activities combined.
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.	Noted and agreed. The formation of committee with list of members has been submitted to the AD mines office, Virudhunagar and the same will be update in every year.
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.	As per the committee agreement the blasting frequency will be discussed and carryout by the Mines Manager appointed by the proponents and the same will be updated in the committee minutes. Transport details in chapter-2.
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.	The risk management plan and disaster management plan will be followed as per this EIA report.
6	The Cluster Management Committee 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 in the EIA Report.	Noted and agreed.
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	Noted and agreed A proper action plan regarding the restoration will be followed by the committee.
8	The committee shall deliberate on the health of the workers/staff involved in the mining as well as the health of the public in the vicinity.	Noted and agreed.
Agriculture & Agro - Biodiversity		
9	Impact on surrounding agricultural fields around the proposed mining Area.	Noted and agreed 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.

10	Impact on soil flora & vegetation around the project site.	Noted and agreed The vegetation details have been provided in chapter 3. 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.
11	Details of type of vegetations including no. of trees & shrubs within the proposed mining area and, If so, transplantation of such vegetations all along the boundary of the proposed mining area shall committed mentioned in EMP.	Noted and agreed The vegetation details have been provided in Chapter No 3. 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.
12	The Environmental Impact Assessment should study the biodiversity, the natural ecosystem, the soil micro flora, fauna and soil seed banks and suggest measures to maintain the natural Ecosystem	Noted and agreed The EIA study has been carried out as per this ToR Condition. The details are given in the EIA report Chapter No 3
13	Action should specifically suggest for sustainable management of the area and restoration of ecosystem for flow of goods and services.	Noted and agreed The Eco System of the area will be retained during the mining operation by the way of planting trees in the boundary barrier and un utilized areas. After completion of mining operation, the quarried-out pit will be facilitated to collect the rainwater to pit act as temporary reservoir.
14	The project proponent shall study and furnish the impact of project on plantations in adjoining patta lands, Horticulture, Agriculture and livestock.	The project area is bounded by Existing quarries on the all side of the lease area.
Forests		
15	The project proponent shall detail study on impact of mining on Reserve forests free ranging wildlife.	There is no Reserve Forest within 1km radius from the project area. The mining operation will not cause any significant impact to the Reserve Forest and Wild life Sanctuaries
16	The Environmental Impact Assessment should study impact on forest, vegetation, endemic, vulnerable and endangered indigenous flora and fauna.	Details of flora and fauna studies given in the Chapter No.3
17	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection	Noted and agreed
18	The Environmental Impact Assessment should study impact on protected areas, Reserve Forests, National Parks, Corridors and Wildlife pathways, near project site.	Noted and agreed
Water Environment		
19	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 any ecological fragile areas. 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.	Hydro-geological study considering the open well and borewell within the radius of 1km along with water level contour map. The details are given in the Chapter No.3.
20	Erosin Control measures	Noted and agreed

		Garland drainage structures will be constructed around the lease area to control the erosion, as discussed in Section 4.3 under Chapter 4.
21	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area on the nearby Villages, Water-bodies/ Rivers, & any ecological fragile areas.	Details in Chapter 3- Detailed EIA study has been carried out considering the impact to the water bodies and eco system of the area. Details are covered in the Chapter No 3 and 4.
22	The project proponent shall study impact on fish habitats and the food WEB/ food chain in the water body and Reservoir.	Noted & agreed Details discussed in Chapter 3 and 4 impact of bio diversity
23	The project proponent shall study and furnish the details on potential fragmentation impact of natural environment, by the activities.	Noted & agreed
24	The project proponent shall study and furnish the impact on aquatic plants and animals in water bodies and, possible scars on the landscape damages to nearby caves, heritage site, and archaeological sites possible land form changes visual and aesthetic impacts.	Noted & agreed. Details discussed under Chapter 3.
25	The Terms of Reference should specifically study impact on soil health, soil erosion, the soil physical, chemical components and microbial components.	Noted & agreed Details of impact on soil health, soil erosion, the soil, physical, chemical components and microbial components described in chapter-3.
26	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites.	Noted & agreed
27	The EIA shall include the impact of mining activity on the following: a) Hydrothermal/Geothermal effect due to destruction in the Environment. b) Bio-geochemical processes and its foot prints including Environmental stress.	Noted & agreed
Energy		
28	The measures taken to control Noise, Air, Water, Dust Control and steps adopted to efficiently utilise the Energy shall be furnished.	The mitigation measures to control the Noise, Air, Water and dust is given in the Chapter No.4.
Climate Change		
29	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.	Details of carbon emission and mitigation activities are given in the Chapter No.4
30	The Environmental Impact Assessment should study impact on climate change, temperature rise, pollution and above soil & below soil carbon stock, soil health and physical, chemical & biological soil features.	Noted & agreed
31	Impact of mining on pollution leading to GHGs emissions and the impact of the same on the local livelihood.	Noted & agreed
Mine Closure Plan		
32	Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued and the scope for achieving SDGs.	Details in Chapter 2 mine closure plan
EMP		
33	Detailed Environment Management Plan along with adaptation, mitigation & remedial strategies covering the entire mine lease period as per precise area communication order issued.	The detailed Environmental Management plan has been prepared and given in the Chapter No.10

34	The Environmental Impact Assessment should hold detailed study on EMP with budget for green belt development and mine closure plan including disaster management plan.	Details in Green belt development in chapter 4
Risk Assessment		
35	To furnish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	The risk assessment and its management plan for this project has been provided in Chapter No. 7.
Disaster Management Plan		
36	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.	The disaster management plan for this project has been provided in Chapter No. 7.
Others		
37	The project proponent shall furnish VAO certificate with reference to 300m radius regard to approved habitations, schools, Archaeological sites, Structures, railway lines, roads, water bodies such as streams, odai, vaari, canal, channel, river, lake pond, tank etc.	The Project Proponent have obtained VAO certificate and it will be attached in the annexure.
38	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 Plan.	Noted and agreed
39	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.	Details of carbon emission and mitigation activities are given int the Chapter No.4

STANDARD TERMS OF REFERENCE		
1	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.	Not applicable. This is Not a violation category project. This proposal falls under B1 Category (Cluster Condition).
2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given	The applied land for quarrying is a Patta Land. Document is enclosed along with Approved Mining Plan as Annexure Volume 1.
3	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee	Noted & agreed.
4	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/topo sheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone)	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.4, Project area boundary coordinates superimposed on Toposheet – Figure No. 1.3, Surface Features around the project area covering 10km radius – Figure No. 2.5, Geology map of the project area covering 10km radius – Figure No. 2.8, Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.9,
5	Information should be provided in Survey of India Topo sheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics	Map showing – Geology map of the project area covering 10km radius – Figure No. 2.8, page Geomorphology Map of the Study Area covering 10 km radius – Figure No. 2.9,
6	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority	The applied area was inspected by the officers of Department of Geology along with revenue officials and found that the land is fit for quarrying under the policy of State Government.
7	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/violation of the environmental or forest norms/ conditions? The hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report	The proponent has framed their Environmental Policy and the same is discussed in the Chapter No 10,

8	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided	It is an opencast quarrying operation proposed to operate in Mechanized method. The rough stone formation is a hard, compact and homogeneous body. The height and width of the bench will be maintained as 5m with 90° bench angles. Quarrying activities will be carried out under the supervision of Competent Persons like Mines Manager, Mines Foreman and Mining Mate. Necessary permissions will be obtained from DGMS after obtaining Environmental Clearance.
9	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine / lease period.	Noted & agreed. The study area considered for this study is 10 km radius and all data contained in the EIA report such as waste generation etc., is for the Life of the Mine / lease period.
10	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use and land cover of the study area is discussed in Chapter No. 3. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2.
11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given.	Not Applicable. There is no waste anticipated during this quarry operation. The entire quarried out rough stone will be transported to the needy customers. No Dumps is proposed outside the lease area.
12	Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary, claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees	Not Applicable. There is no Forest Land involved in the proposed project area. The proposed project area is a patta land. Approved Mining Plan is enclosed as Annexure Volume 1.
13	Status of forestry clearance for the broken-up area and virgin forest land involved in the Project including deposition of Net Present Value (NPV) and Compensatory Afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	Not Applicable. The proposed project area does not involve any Forest Land.
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest rights) Act, 2006 should be indicated.	Not Applicable. The project doesn't attract Recognition of Forest Rights Act, 2006.
15	The vegetation in the RF / PF areas in the study area, with necessary, details, should be given	No Reserve Forest within the Study Area.

16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
17	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/ (existing as well as proposed), if any, within 10 km of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished.	Not Applicable. There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
18	A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	Detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] was carried out and discussed under Chapter No. 3 There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area.
19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravali Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining 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 with respect to 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	Not Applicable. There are no approved habitations within a radius of 300 meters.

	sections of the society in the study area, a need-based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socioeconomic aspects should be discussed in the Report.	Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
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 predominant downwind direction. The mineralogical composition of PM ₁₀ , particularly for free silica, should be given.	Baseline Data were collected for One Season (Pre-Monsoon) October 2025 – December 2025 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3, Page no. 34.
23	Air quality modelling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of Vehicles for transportation of mineral. The details of the model used and input parameters used for modelling should be provided. The air quality contours may be shown on a location map clearly, indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Air Quality Modelling for prediction of incremental GLC's of pollutant was carried out using AERMOD view 9.6.1 Model. Details in Chapter No. 4, Page no. 107.
24	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total Water Requirement: 2.4KLD Discussed under Chapter 2, Table No 2.14, page no. 32.
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 rain water harvesting proposed in the project, if any, should be provided.	Part of the working pit will be allowed to collect rain water during the spell of rain will be used for greenbelt development and dust suppression.

		The Mine Closure Plan is prepared for converting the excavated pit into rain water harvesting structure and serve as water reservoir for the project village during draught season.
27	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	Impact Studies and Mitigation Measures of Water Environment including Surface Water and Ground Water are discussed in Chapter 4.
28	Based on actual monitored data, it may clearly be shown whether working will intersect. Ground water. 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 inferred 118 m below ground level. The ultimate depth of quarry is 57m bgl. This proposal of 57m bgl will not intersect the ground water table, which is inferred from the hydro-geological studies carried out at the project site. Discussed under Chapter 3.
29	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.	Not Applicable. There is no stream, seasonal or other water bodies passing within the project area. Therefore, no modification/ diversion of water bodies is anticipated.
30	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and bgl. A schematic diagram may also be provided for the same.	Highest elevation of the project area is 95m (max) AMSL. The ultimate depth of quarry is 57m bgl. Water level of the area is 118 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.	Greenbelt Development Plan is discussed under Chapter 4 & 7.
32	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.	Traffic density survey was carried out to analyse the impact of Transportation in the study area as per IRC guidelines 1961 and it is inferred that there is no significant impact due to the proposed transportation from the project area. Details in Chapter 2.

33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Infrastructure & other facilities will be provided to the Mine Workers after the grant of quarry lease and the same has been discussed in the Chapter No. 2.
34	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report	Discussed under Chapter 2, Mine Closure Plan is a part of Approved Mining Plan enclosed as Annexure Volume – 1.
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational Health Impacts of the project and preventive measures are detailed under Chapter 4.
36	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	No Public Health Implications anticipated due to this project Details of CER and CSR are discussed under Chapter 8.
37	Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	No Negative Impact on Socio Economic Environment on the Study Area is anticipated and this project shall benefit the Socio-Economic Environment by ways of employment for 34 people directly and 50 people indirectly. Details in Chapter 4.
38	Detailed Environmental Management Plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Detailed Environment Management Plan for the project to mitigate the anticipated impacts described under Chapter 4 is discussed under Chapter 10.
39	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the project.	The outcome of public hearing will be updated in the final EIA/AMP report
40	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	No litigation is pending in any court against this project.
41	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Project Cost is Rs. 3,46,66,000/- CER Cost is Rs.3,00,000/- The EMP budget detailed in chapter 10, table no. 10.9
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report	Details in Chapter 7.
43	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Details in Chapter 8.
44	Besides the above, the below mentioned general points are also to be followed: -	
a	Executive Summary of the EIA/EMP Report	Enclosed as separate booklet.
b	All documents to be properly referenced with index and continuous page numbering.	All the documents are properly referenced with index and continuous page numbering.

c	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	List of Tables and source of the data collected are indicated.
d	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project	Baseline monitoring reports are enclosed with This report in Chapter 3. Original Baseline monitoring reports will be submitted in the final EIA report during appraisal.
e	Where the documents provided are in a language other than English, an English translation should be provided.	Not Applicable.
f	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	Will be enclosed along with Final EIA EMP Report.
g	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF&CC vide O.M. No. J-11013/41/2006-IAII(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	Noted & agreed. Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IAII (I) Dated: 4th August, 2009 are followed.
h	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation	Noted & agreed.
i	As per the circular no. J-11011/618/2010-IAII(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not Applicable.
j	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Surface Plan – Figure No. 2.3 Topography, Geological, Year-Wise Development Production Plan and Sections Plan - Figure No.2.10 Mine Closure Plan – Figure No.2.11.

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1.INTRODUCTION

1.0 PREAMBLE

The project proponent Thiru. R. Hariharasudhan applied for Rough stone and Gravel quarry over an extent of 3.59.0 Ha in S.F.Nos- 3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6 of Sundakottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State.

- Proponent applied for Rough Stone and Gravel quarry lease on 15.03.2025
- Precise area communication letter was issued by the District Collector vide letter no. Roc. No. 25VNR0402658, Dated: 26.08.2025
- The Mining plan has been prepared by the Qualified person and got approved by the Deputy Director vide letter no. Roc. No. 25VNR0402658, Dated: 07.10.2025
- The mining plan has been approved for the quantity of 7,40,985m³ of rough stone and gravel 50,060 m³ up to a depth of 57m bgl for the period of Five years.

As per the EIA Notification, 2006 and subsequent amendments and OM The proposal falls in the B1 Category (Cluster quarries - 1 proposal and 6 Existing quarry forming Cluster Category {Total Extent of the Cluster is 16.30.5Ha}- Cluster area calculated as per MoEF& CC Notification S.O. 2269(E) Dated 1st July 2016).

- Proponent applied for Terms of Reference vide Proposal No. SIA/TN/MIN/556839/2025, Dated: 04.11.2025 and the ToR was Granted vide File No: 12955 ToR Identification No: TO25B0108TN5934988N Dated: 29.12.2025

Based on the ToR Baseline Monitoring study has been carried out for one season i.e., **October to December 2025** and this EIA/EMP report is prepared for considering cumulative impacts arising out of these projects, the Cumulative Environmental Impact Assessment study is undertaken, which is followed by preparation of a detailed Environmental Management Plan (EMP) to minimize those adverse impacts.

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

1.1 PURPOSE OF THE REPORT

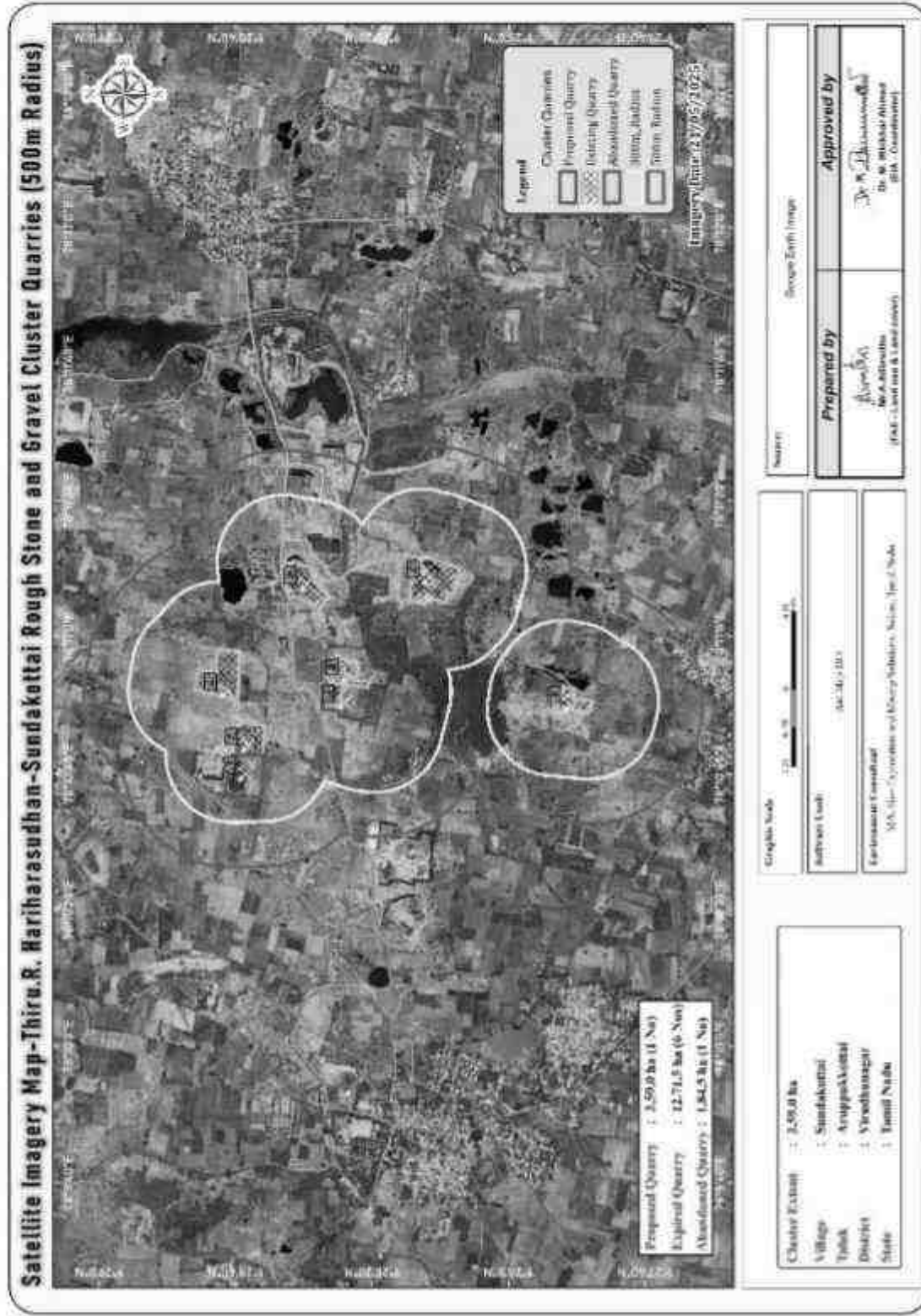
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14th September 2006 and its subsequent amendments as per Gazette Notification S.O. 1886 of 20th April 2022, Mining Projects are classified under two categories i.e. A (>250 Ha) and B ($\leq$ 250 Ha), and Schematic Presentation of Requirements on Environmental Clearance of Minor Minerals including cluster situation in Appendix-XI.

Now, as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No. 186 of 2016 and MoEF& CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018 clarified the requirement for EIA, EMP and therefore, Public Consultation for all areas from 5 to 25 ha falling in Category B1 and appraised by SEAC/ SEIAA as well as for cluster situation.

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

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

FIGURE 1.1: SATELLITE IMAGERY CLUSTER QUARRIES



1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1 Identification of Project Proponent

TABLE 1.1: DETAILS OF PROJECT PROPONENT

Name of the Project Proponent	Thiru. R. Hariharasudhan
Address	S/o. Raja, No. 27, Guru Bhagavan Illam, Star Nagar 5th Street, P and T Nagar Anaiyur, Madurai North Taluk, Madurai District – 625 017
Mobile	+91 98430 50945
Email	rhshari@gmail.com
Status	Individual

1.2.2 Identification of Project

TABLE 1.2: SALIENT FEATURES OF THE PROPOSED PROJECT

Name of the Project	Thiru. R.Hariharasudhan Rough stone and Gravel quarry	
S.F. No.	3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6	
Extent	3.59.0 Ha	
Village Taluk and District	Sundakkottai Village, Aruppukottai Taluk, Virudhunagar District	
Land Type	It is a Patta land – Punjai, registered in the name of the applicant (Thiru. R.Hariharasudhan), vide Patta No. 635,641 and 648.	
Toposheet No	58 – K/03	
Latitude between	09°28'18.1601"N to 09°28'27.3291"N	
Longitude between	78°10'47.0425"E to 78°10'53.1109"E	
Elevation of the area	95m AMSL	
Mining Plan period	5 Years	
Proposed Depth of Mining	57m bgl	
	Rough Stone in m³	Gravel in m³
Geological Resources	19,80,605	59,654
Mineable Reserves	7,40,985	50,060
Year wise Production	7,40,985	50,060
Peak Production	1,93,070	17,822
Ultimate Pit Dimension	XY-AB: 63m (L) X 107m (W) X 42m (D) BGL XY-CD: 181m (L) X 133m (W) X 57m (D) BGL	
Water Level in the region	118m bgl	
Method of Mining	Opencast Mechanized Mining Method is being carried out with 5.0-meter vertical bench with a bench width is not less than the bench height	
Topography	The lease applied area is almost plain topography. The area has gentle sloping towards Northwestern side and altitude of the area is 95m (max) above Mean Sea level. The area is covered by 2m thickness of Gravel and 2m thickness of weathered rock. Massive Charnockite which is clearly inferred from the existing quarry pit.	
Machinery proposed	Hand Jack Hammer	4 Nos
	Compressor	1 No

	Wagon Drill Machine	1 No
	Excavator with Bucket and Rock Breaker	2 Nos
	Trucks	5 Nos
	Water sprinkler	1 No
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	34 Nos	
Project Cost	Rs. 3,46,66,000/-	
CER Cost	Rs. 3,00,000/-	
Nearby Water Bodies	Odai	20m SE
	Odai	90m East
	Sundakollai Kanmoi	300m South
	Tank	350m North
	Tank	1.5km NE
	Gundar River	6km NE
Greenbelt Development Plan	Proposed to plant 1800 Nos of trees considering 500 Nos of trees/ Ha criteria. The plantation will be developed around the project site and nearby village roads.	
Proposed Water Requirement	2.4 KLD	
Nearest Habitation	1.3km – South East	
Nearest Reserve Forest	Vidathakulam R.F -15.3km-NE	
Nearest Wild Life Sanctuary	Kanjirankulam Birds Sanctuary – 34.5km - SE Chitrangudi Bird Sanctuary – 35.5km - SE	

Source: Approved Mining & Land Documents.

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 Nature and Size of the Project

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

The peak production of Rough stone is 1,93,070 m³ maximum in a year (644m³ per day/ 54 Tippers per day considering 12m³ per load). The depth of the mining is 57m bgl.

1.3.2 Location of the Project

- The project sites located in Sundakkottai Village, Aruppukottai Taluk, Virudhunagar District, Tamil Nadu State.
- The lease applied area is located about 26.1km Southeast side of Virudhunagar, 9.9km Southeast side of Aruppukottai town and 2.0km North-western side of Sundakkottai Village.

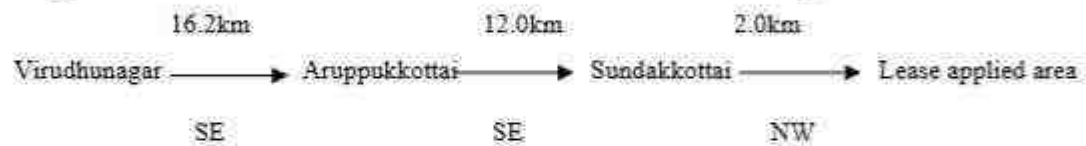


FIGURE 1.2: LOCATION MAP OF THE PROJECT SITE

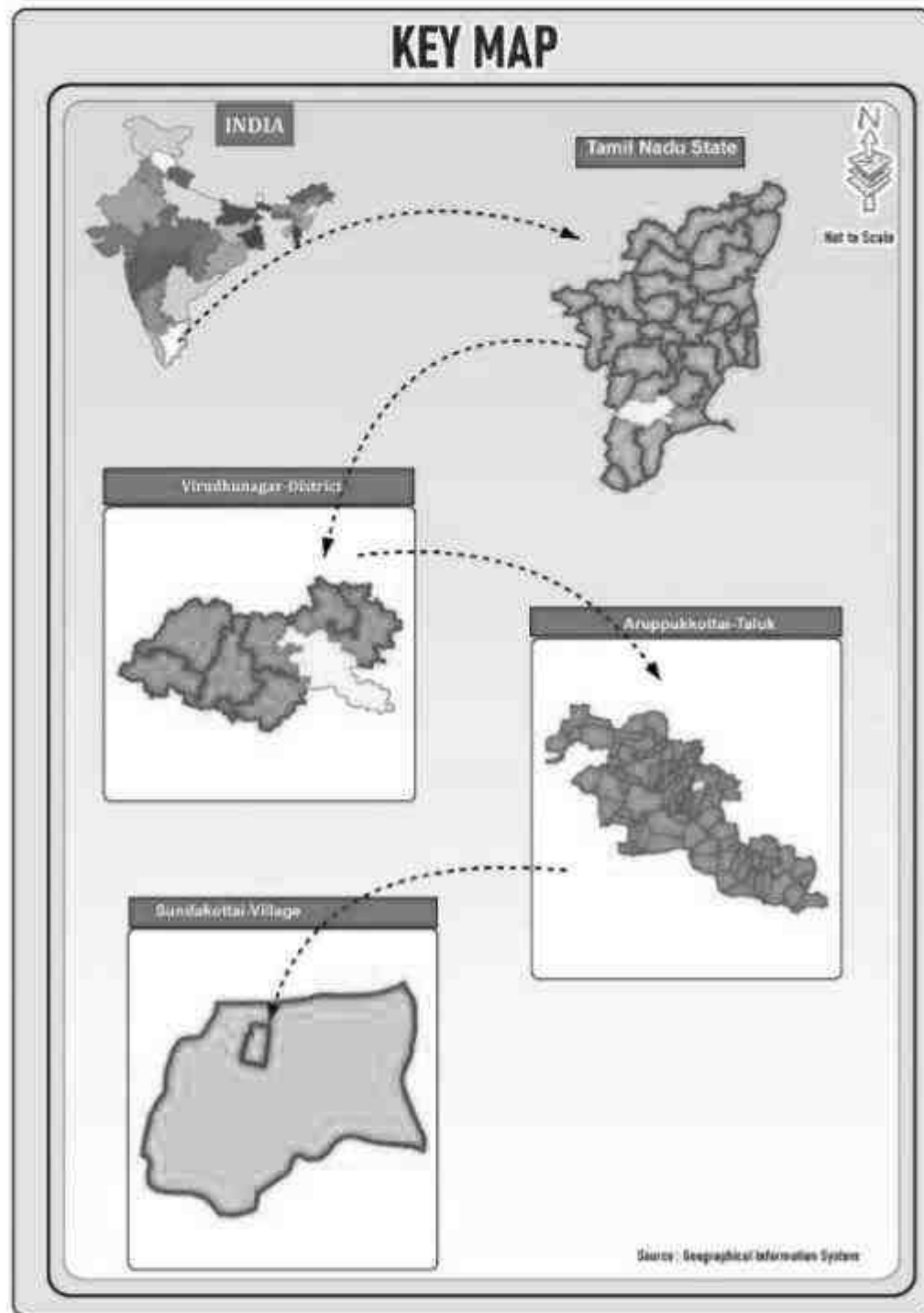


FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS

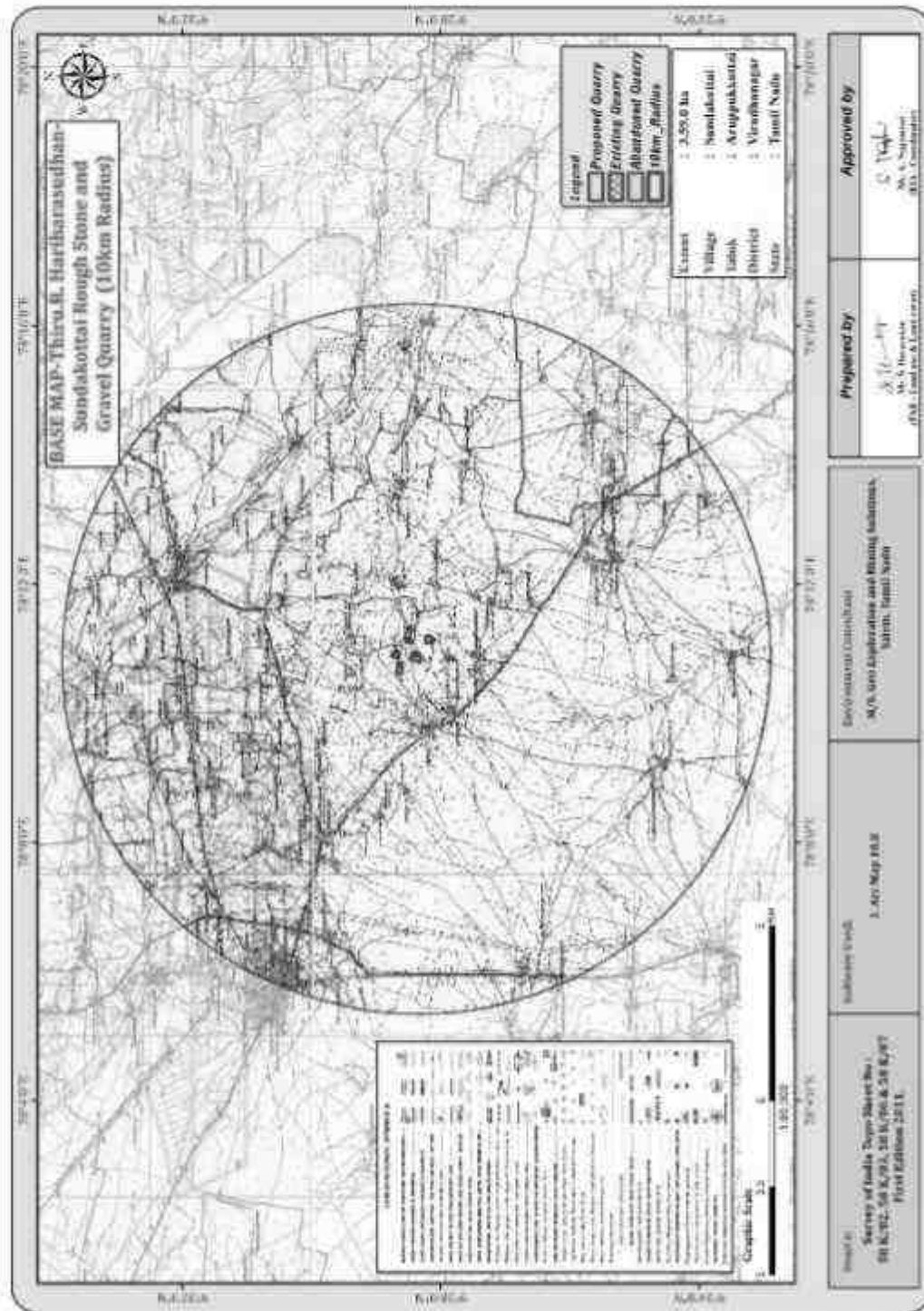
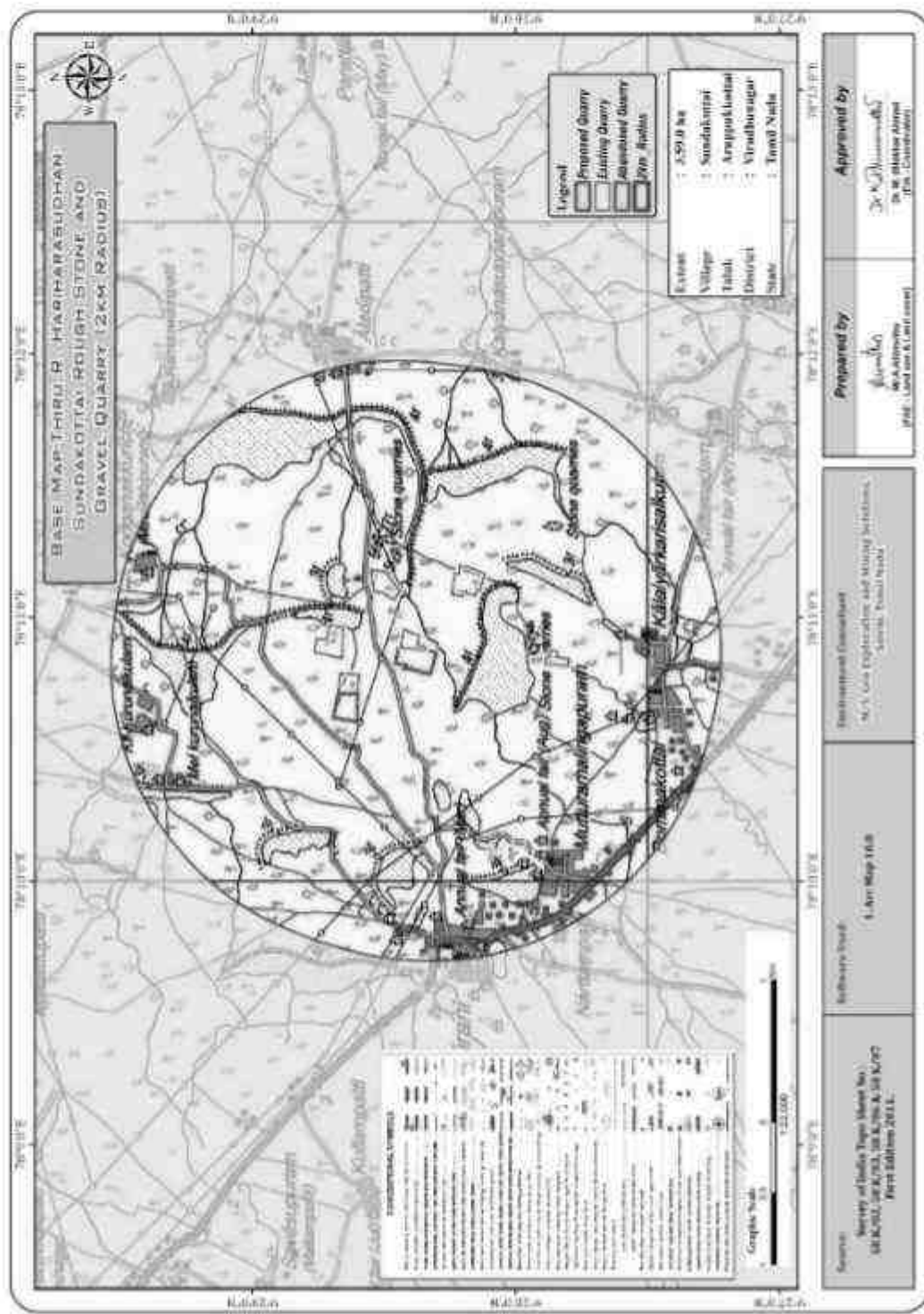


FIGURE 1.4: TOPOSHEET MAP OF THE STUDY AREA 2KM RADIUS



1.4 ENVIRONMENTAL CLEARANCE

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

- Screening,
- Scoping
- Public consultation &
- Appraisal

SCREENING

- Proponent applied for Rough stone and Gravel quarry lease on 15.03.2025
- Precise area communication letter was issued by the District Collector vide letter no. Roc. No. 25VNR0402658, Dated: 26.08.2025
- The Mining plan has been prepared by the Qualified person and got approved by the Deputy Director vide letter no. Roc. No. 25VNR0402658, Dated: 07.10.2025
- The mining plan has been approved for the quantity of 7,40,985m³ of Rough stone and Gravel 50,060 m³ up to a depth of 57m bgl for the period of Five years.
- The proposed project falls under "B1" Category as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No. 186 of 2016 and MoEF& CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018

SCOPING:

- Proponent applied for Terms of Reference vide Proposal No. SIA/TN/MIN/556839/2025, Dated: 04.11.2025
- The proposal was placed in 642nd SEAC meeting held on 13.11.2025 and the committee recommended for issue of ToR.
- The proposal was considered in 924th SEIAA meeting held on 27.11.2025 & 935th SEIAA meeting held on 19.12.2025 and issued ToR vide File No: 12955 ToR Identification No: TO25B0108TN5934988N Dated: 29.12.2025

PUBLIC CONSULTATION

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

APPRAISAL –

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

1.5 TERMS OF REFERENCE (ToR)

The ToR was issued by the SEIAA vide File No: 12955 ToR Identification No: TO25B0108TN5934988N Dated: 29.12.2025. The Details of the ToR Compliance is given in the Page No. A

1.6 POST ENVIRONMENT CLEARANCE MONITORING

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

1.7 GENERIC STRUCTURE OF EIA DOCUMENT

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

1.8 THE SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the Retreating Monsoon season (October 2025 to December 2025) for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suggest suitable mitigation measures for likely adverse impacts due to the proposed project.

TABLE 1.3: ENVIRONMENT ATTRIBUTES

Sl.No.	Attributes	Parameters	Source and Frequency
1	Ambient Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂	Continuous 24-hourly samples twice a week for three months at 7 locations (2 Core & 5 Buffer)
2	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	Near project site continuous for three months with hourly recording and from secondary sources of IMD station
3	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 6 locations – 2 Surface water and 4 Ground water samples; once during study period.

4	Ecology	Existing terrestrial and aquatic flora and fauna within 10 km radius circle.	Limited primary survey and secondary data was collected from the Forest department.
5	Noise levels	Noise levels in dB(A)	7 Locations – data monitored once for 24 hours during EIA study.
6	Soil Characteristics	Physical and Chemical Parameters	Once at 6 locations during study period.
7	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics.	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas.	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances.	Based on the findings of Risk analysis done for the risk associated with mining.

Source: Field Monitoring Data

1.8.1 Regulatory Compliance & Applicable Laws/Regulations for all Proposed Quarries

- Application for Quarrying Lease as per Tamil Nadu Minor Mineral Concession Rules, 1959.
- Obtained Precise Area Communication Letter as per Tamil Nadu Minor Mineral Concession Rules, 1959 for Preparation of Mining Plan and obtaining Environmental Clearance.
- The Mining Plan has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959.
- Environment Protection Act, 1986
- EIA Notification, 2006
- ToR vide File No: 12955 ToR Identification No: TO25B0108TN5934988N Dated: 29.12.2025

2. PROJECT DESCRIPTION

2.0 GENERAL

The Proposed Rough Stone and Gravel Quarry requires Environmental Clearance. There are 1 proposed, and 6 existing quarry forming a cluster; calculated as per MoEF& CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is 16.30.5ha.

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

2.1 DESCRIPTION OF THE PROJECT

The proposed project is site specific and there is no additional area required for this project. There is no effluent generation/discharge from this project. Method of mining is opencast mechanized method involving splitting of rock mass of considerable volume from the parent rock mass by jackhammer drilling and blasting, hydraulic excavators are used for loading the Rough Stone from pithead to the needy crushers and rock breakers to avoid secondary blasting.

2.2 LOCATION OF THE PROJECT

- The project sites located in Sundakkottai Village, Aruppukkottai Taluk, Virudhunagar District, Tamil Nadu State.
- The lease applied area is located about 26.1km Southeast side of Virudhunagar, 9.9km Southeast side of Aruppukkottai town and 2.0km North-western side of Sundakkottai Village.

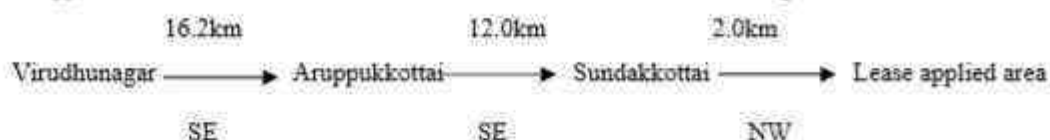


TABLE 2.1: SITE CONNECTIVITY

Nearest Roadway	National Highway- Thoothukudi – Aruppukkottai (NH-38) – 8.3km- North West State Highway - Aruppukkottai – Valinokka (SH-47) – 1.7km - West
Nearest Village	1.3 km – South East
Nearest Town	Kallorani – 1.7km – West
Nearest Railway Station	Tiruchuli Railway station – 7.2km – North East
Nearest Airport	Madurai Airport – 41.1km – North West
Seaport	Thoothukudi Seaport – 77 km – South East

Source: Survey of India Toposheet

TABLE 2.2: CO-ORDINATES- PROJECT BOUNDARY

Corner Nos.	Latitude	Longitude
1	09°28'27.3291"N	78°10'49.3836"E
2	09°28'26.8339"N	78°10'53.1109"E
3	09°28'25.6933"N	78°10'53.0119"E
4	09°28'23.9133"N	78°10'52.8342"E
5	09°28'22.5093"N	78°10'52.6941"E
6	09°28'20.5779"N	78°10'52.4639"E
7	09°28'18.1601"N	78°10'52.0139"E
8	09°28'16.9187"N	78°10'49.0377"E
9	09°28'19.1818"N	78°10'48.1050"E
10	09°28'18.1601"N	78°10'47.0425"E
11	09°28'19.4284"N	78°10'47.3794"E
12	09°28'20.7029"N	78°10'47.1140"E
13	09°28'21.0322"N	78°10'47.1919"E
14	09°28'20.95550"N	78°10'47.4899"E
15	09°28'23.3631"N	78°10'48.0301"E
16	09°28'25.0121"N	78°10'48.4016"E
17	09°28'24.9439"N	78°10'49.1519"E

Source: Approved Mining Plan

FIGURE 2.1: TOPOGRAPHICAL VIEW OF PROJECT AREA

FIGURE 2.1-A: FENCING AND GREEN BELT PHOTOGRAPHS

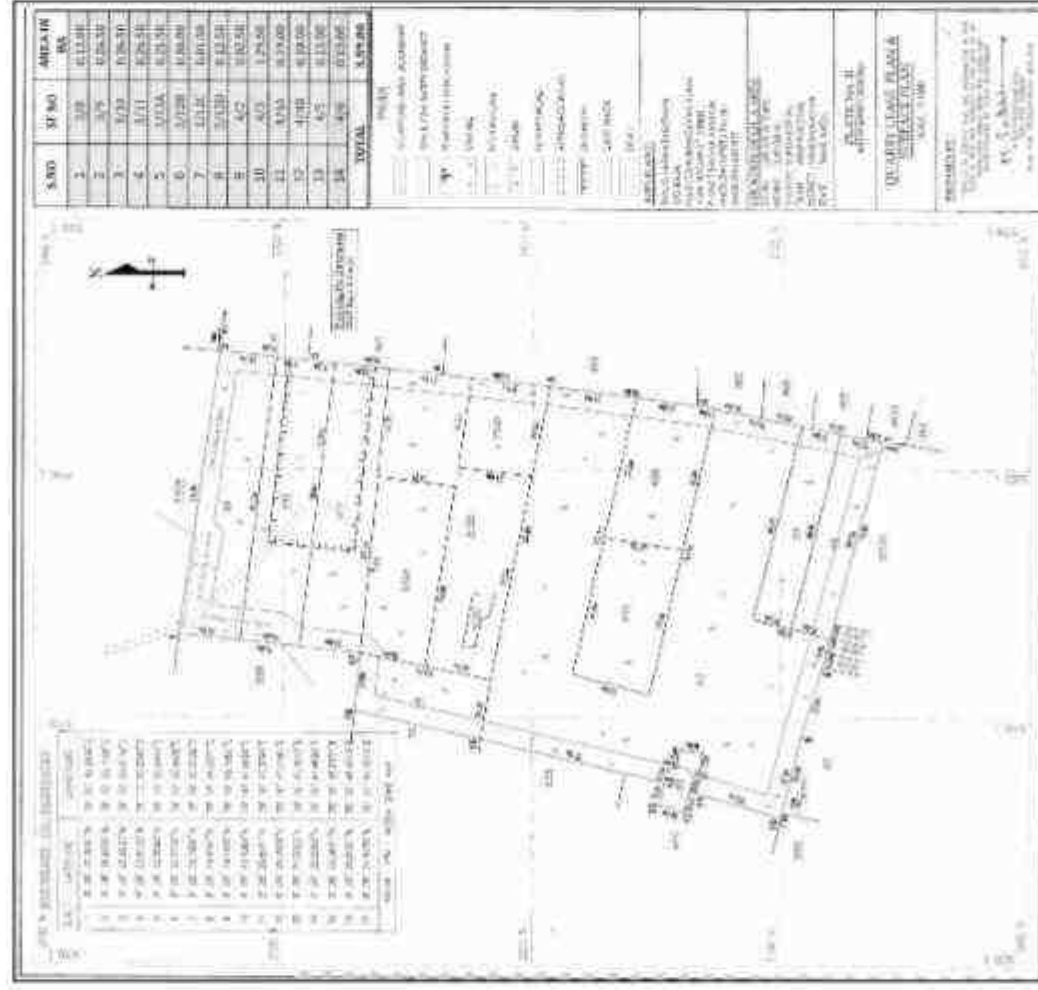


FIGURE 2.2: GOOGLE IMAGE OF THE PROJECT AREA



Source: Google Earth Imagery

FIGURE 2.3: QUARRY LEASE PLAN / SURFACE PLAN



Source: Approved Mining Plan.

FIGURE 2.4: VILLAGE MAP SUPERIMPOSED ON GOOGLE EARTH IMAGE

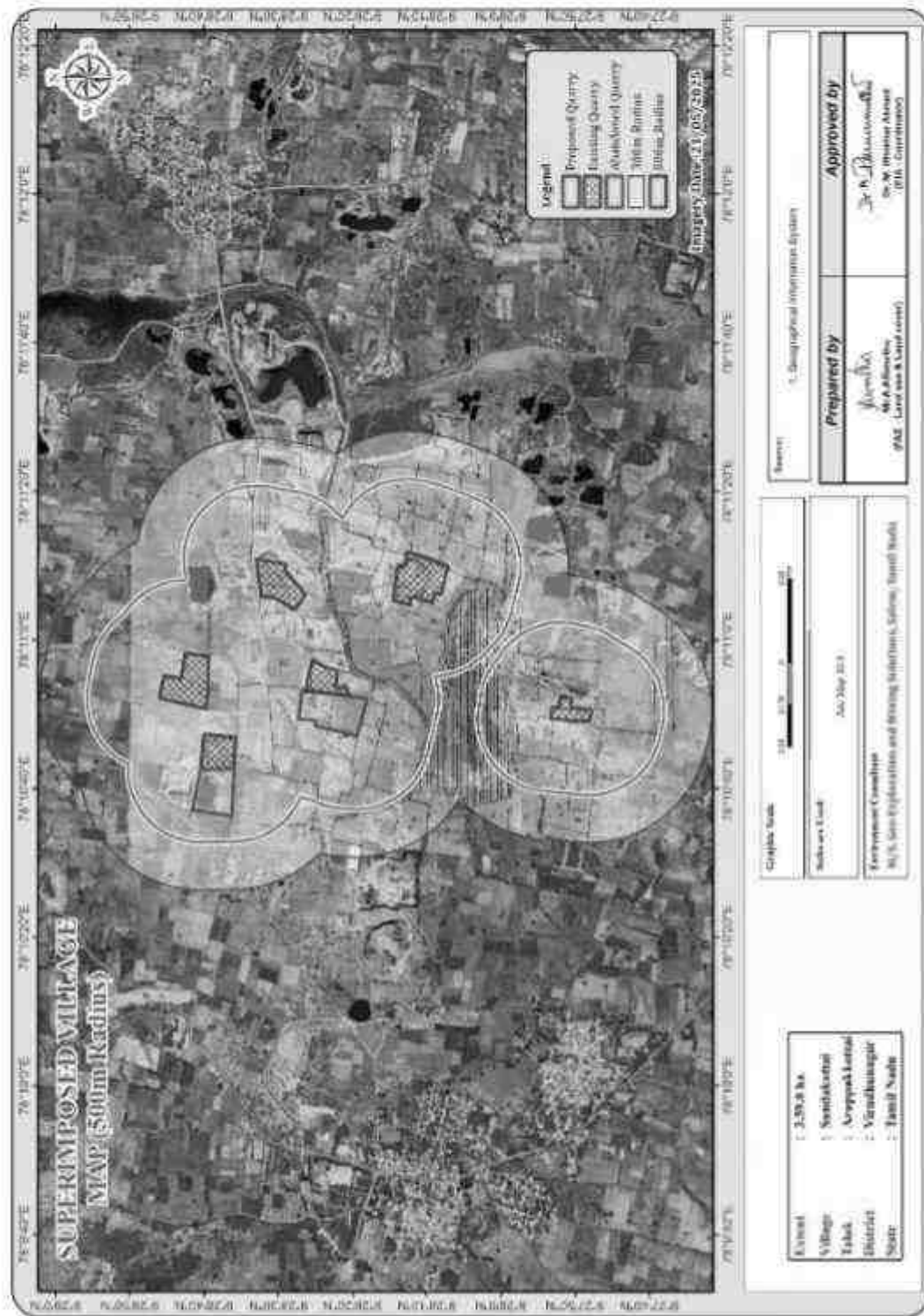


FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS

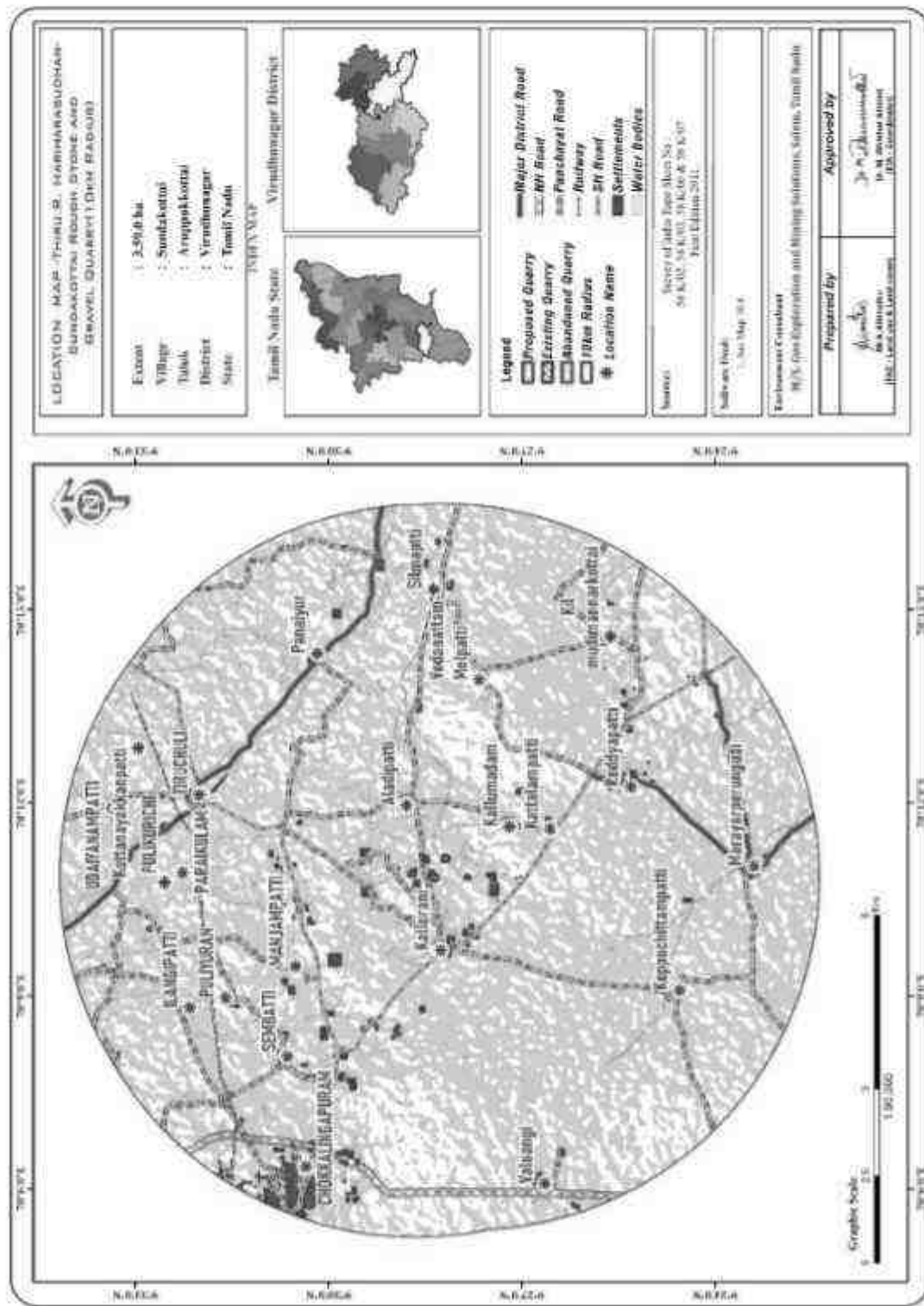


FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 5 KM RADIUS

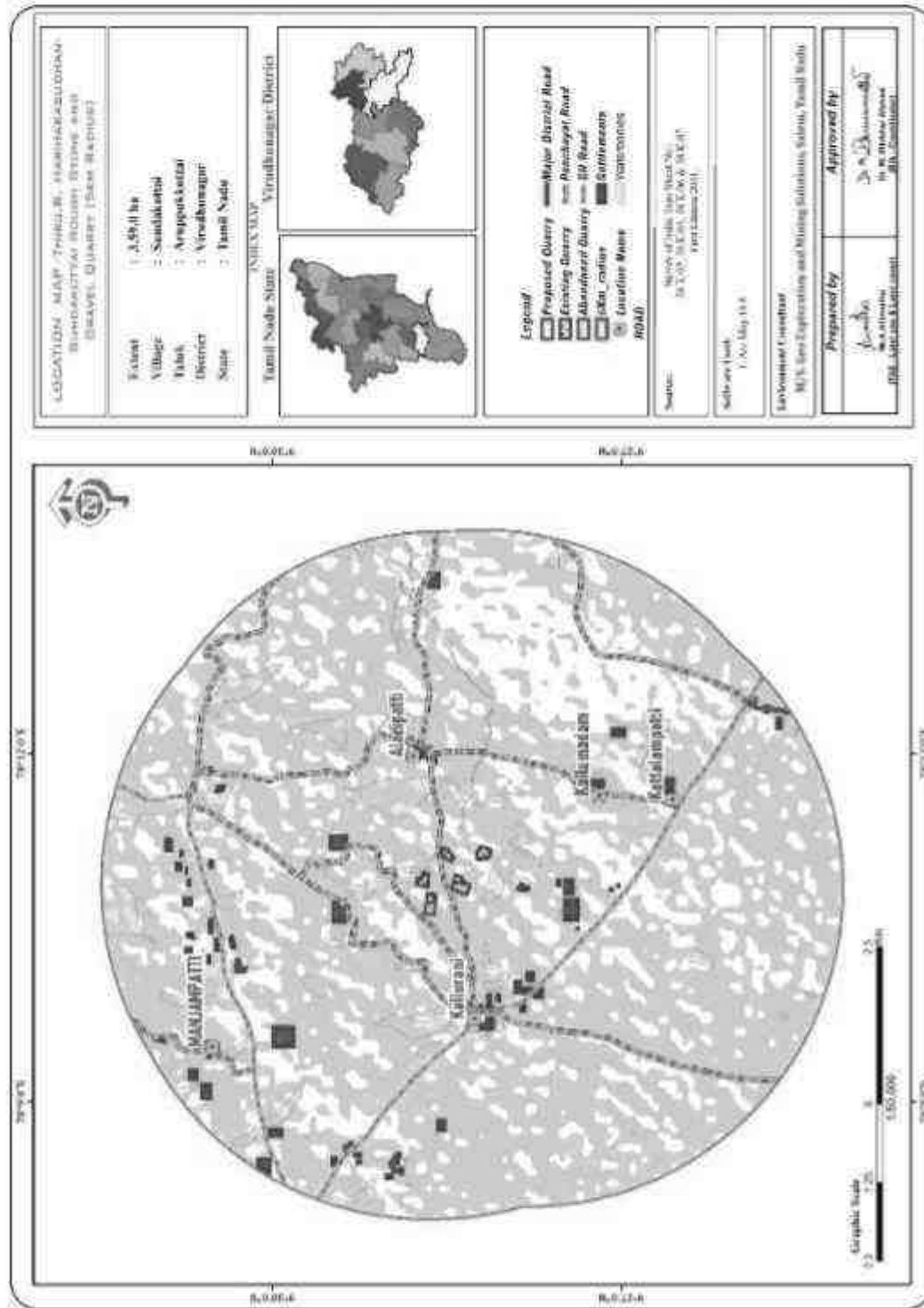
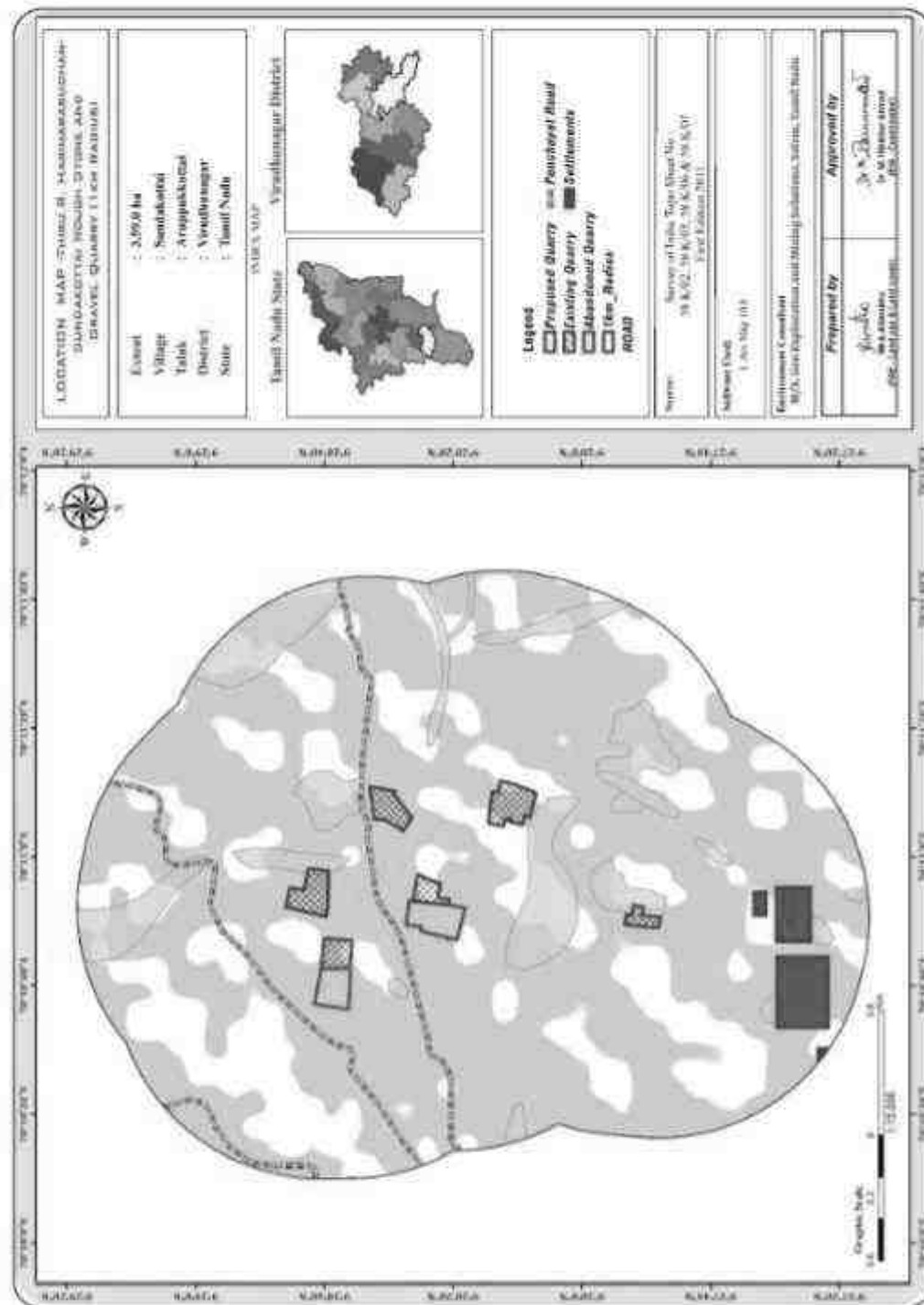


FIGURE 2.7: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS



2.2.1 Project Area

- The project is site specific & no beneficiation or processing in the project site.
- There is no forest land involved in the proposed projects and is devoid of major vegetation and trees.

TABLE 2.3: LAND USE PATTERN

Description	Present area (Ha)	Area at the end of Lease period (Ha)
Area Under Quarrying	0.26.25	2.93.37
Site Services	Nil	0.01.00
Roads	0.01.00	0.01.00
Green Belt	Nil	0.48.80
Untutilized Area	3.31.75	0.14.83
Grand Total	3.59.0	3.59.0

Source: Approved Mining Plan

TABLE 2.4: PRODUCTION DETAILS

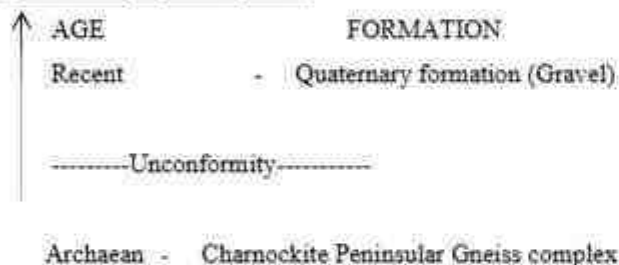
PARTICULARS	DETAILS	
	Rough Stone in m ³	Gravel in m ³
Geological Resources	19,80,605	59,654
Mineable Reserves	7,40,985	50,060
Year wise Production	7,40,985	50,060
Peak Production	1,93,070	17,822
Revised Scheme of Mining Period	5 Years	
Number of Working Days	300 Days	
Production per day	644	
No of Lorry loads	54	
Total Depth of Mining	57m BGL	

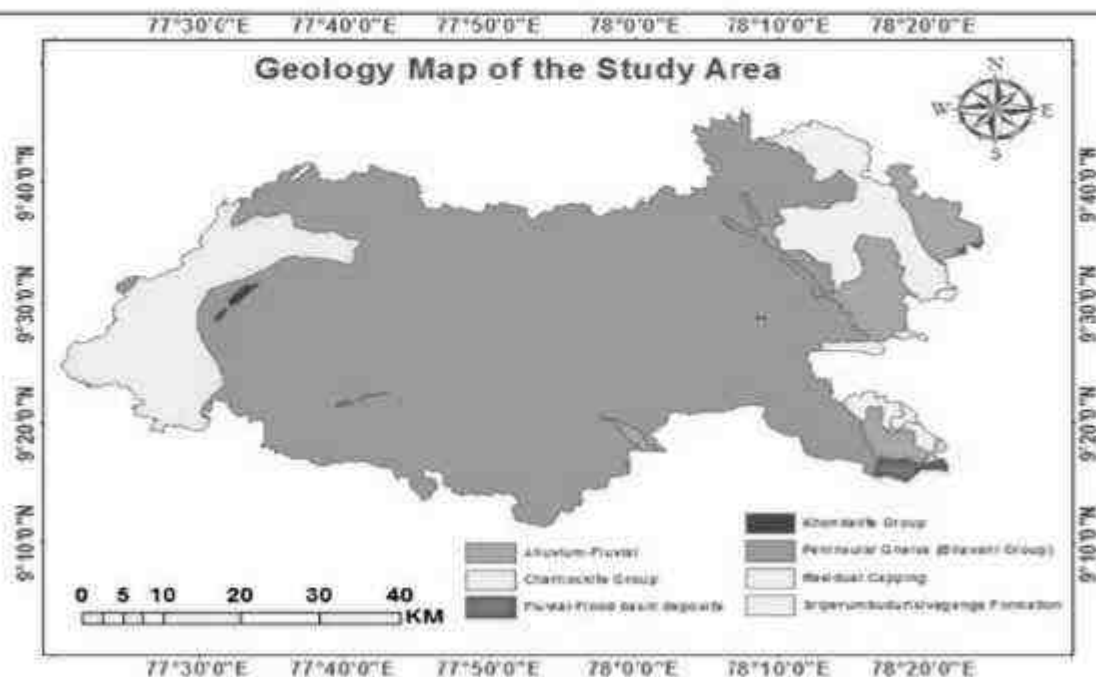
Source: Approved mining plan.

2.3 GEOLOGY

Peninsular gneiss forms the oldest rock formations, in which the massive formation of Charnockite lies over with rich accumulation of recent quaternary formation. On regional scale the Charnockite body N40°E – S40°W with dipping towards SE70°.

Regional stratigraphic sequence:





Geomorphology

Virudhunagar district is bordered by Western Ghats (Ridge and valley complex) in the West. Vally fill area is observed in Watrap block. A major part of the district constitutes a plain terrain with a gentle slope toward East and Southeast, except for the hilly terrain in the west. The prominent geomorphic units identified in the district through interpretation of Satellite imagery are; 1. Flood Plain, 2. Bazada, 3. Pediment, 4. Shallow & deep buried Pediments and 6. Structural Hills.

The district is divisible into three geomorphological units viz the western most hill ranges (denudational hills of Western Ghats), uplands (pediments) and the plains (pediplains). The hill ranges rise upto 2019 meters above mean sea level at Kottaimalai. The other notable hill is Andipatti hill with a NE-SW trend, in the northwestern part of the district. The Vaippar and Gundar rivers which flow to the east are ephemeral streams. The drainage pattern is subdendritic.

2.3.2 Local Geology:

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. The lease applied area is exhibits plain terrain. The area has gentle sloping towards East side. The maximum altitude of the area is 98m above Mean Sea level. The area is covered by 2m thickness of Gravel & 4m weathered Gravel which is clearly inferred from the existing quarry pits in the cluster.

2.3.3 Hydrogeology

Virudhunagar district is underlain entirely by Archaean Crystalline formations with Recent alluvial deposits occurring along the river and streams courses. Weathered, fissured and fractured crystalline rock sand their alluvial deposits constitute the important aquifer systems in the district. The hard consolidated crystalline rocks of Archaean age represent weathered, fissured and fractured formations of gneisses, granites, charnockites and other associated rocks. The Specific capacity of large diameter wells tested in crystalline rocks from 31 to 200 lpm / m. of drawdown.

The yield characteristics of wells vary considerably depending on the topographic set-up, lithology and the degree of weathering.



Source:

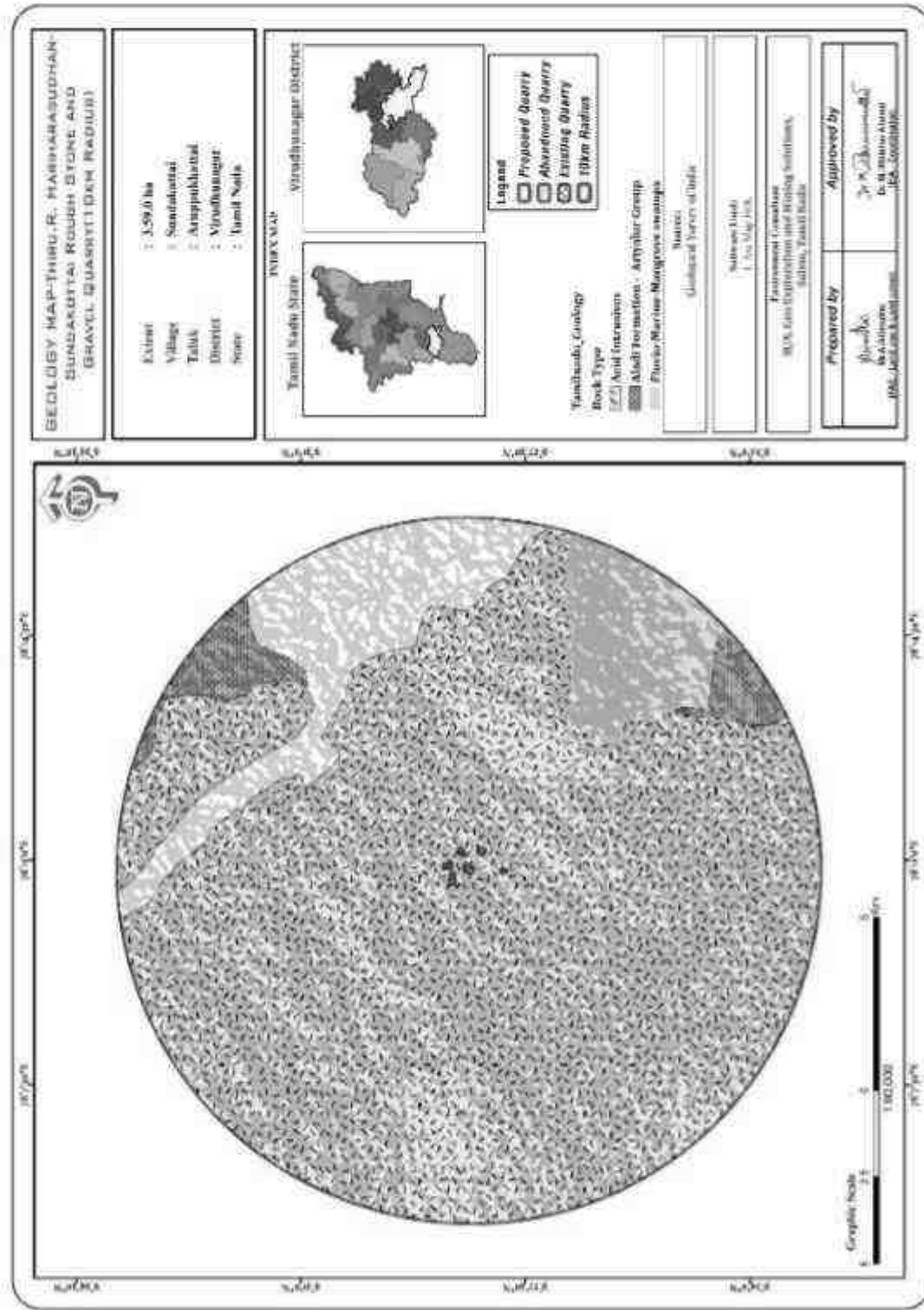
<https://cdn.s3waas.gov.in/s3c86a7ee3d8ef0b551ed58e354a836f2b/uploads/2019/06/2019061311.pdf>

TABLE 2.5: GROUND WATER LEVEL VARIATIONS OF VIRUDHUNAGAR DISTRICT

Jan 2020	May 2020	Jan 2021	May 2021	Jan 2022	May 2022	Jan 2023	May 2023	Jan 2024	May 2024	5 Years Pre-Monsoon Average	5 Years Post Monsoon Average
4.95	9.6	4.3	7.7	2.9	4.8	3.5	5.5	2.17	4.00	6.32	3.56

Source: Virudhunagar | TWAD (tn.gov.in)

FIGURE 2.8: REGIONAL GEOLOGY MAP



2.4 RESOURCES AND RESERVES

The Resources and Reserves of Rough Stone and Gravel were calculated based on Cross-Section Method by plotting sections to cover the maximum lease area. 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 (Safety Barrier all around the applied area) and safety distance as per precise area communication letter and deducting the locked up reserves during bench formation (Also called as Bench Loss) and the Mineable Reserves is calculated considering there is no waste / overburden / side burden (100% Recovery Anticipated).

TABLE 2.6: RESOURCES AND RESERVES

Description	Rough Stone in m ³	Gravel in m ³
Geological Resource in m ³	19,80,605 m ³	59,654 m ³
Mineable Resource in m ³	7,40,985 m ³	50,060 m ³

Source: Approved Mining Plan

TABLE 2.7: YEAR-WISE PRODUCTION PLAN

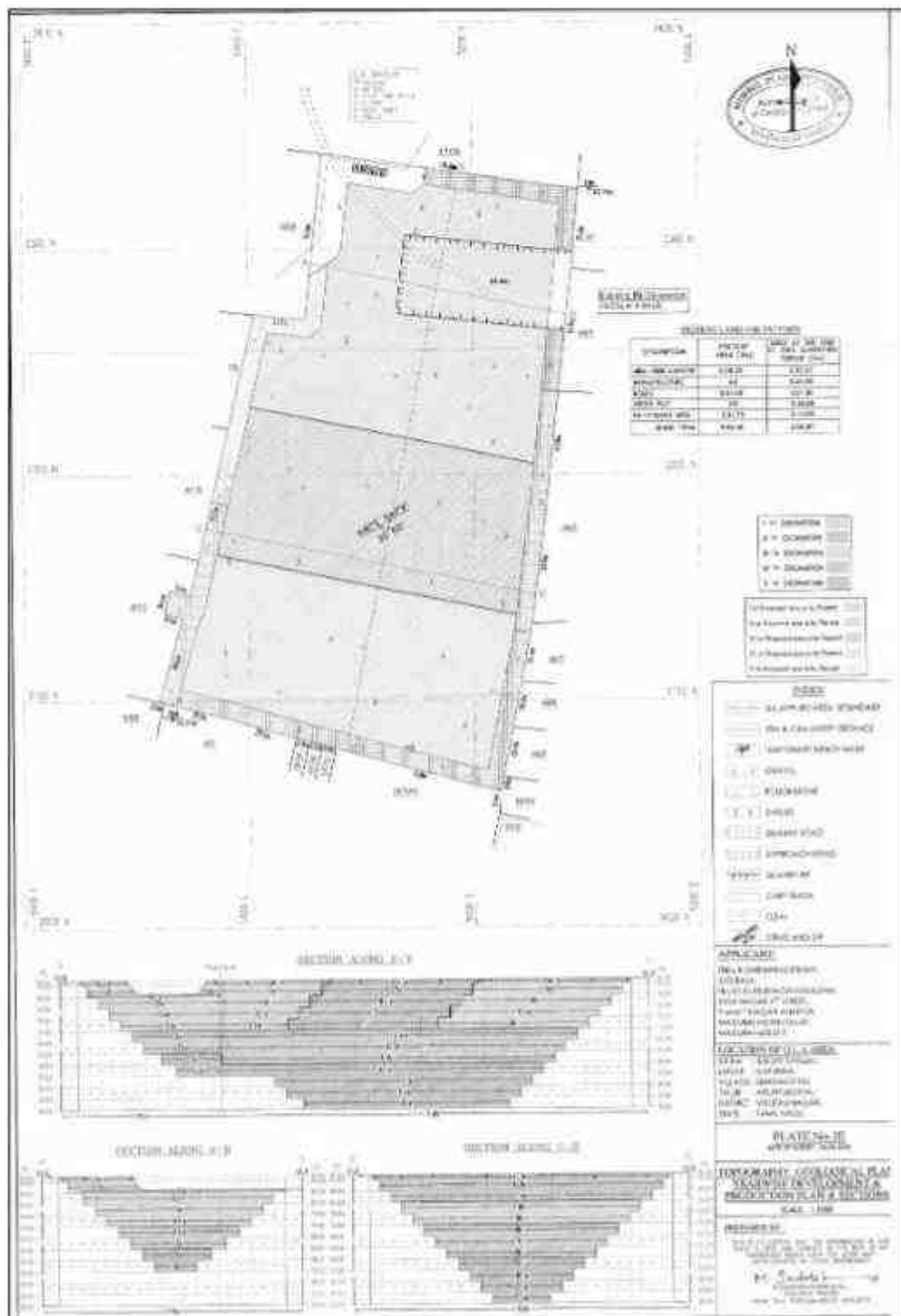
Years	Rough stone	Gravel
I	4,12,212 Ts/ 1,49,895 m ³	29,364 Ts/ 14,682 m ³
II	4,09,035 Ts/ 1,48,740 m ³	35,644 Ts/ 17,822 m ³
III	4,02,930 Ts/ 1,46,520 m ³	35,112 Ts/ 17,556 m ³
IV	5,30,942 Ts/ 1,93,070 m ³	-
V	2,82,590 Ts/ 1,02,760 m ³	-
Total	20,37,709 Ts/ 7,40,985 m³	1,00,120 Ts/ 50,060 m³

Source: Approved Mining Plan

Disposal of Waste

There is no Waste anticipated during this plan period hence, disposal of waste does not arise. The overburden in the form of Gravel and Weathered rock are already removed during the previous lease period. The excavated rough stone (100%) will be directly loaded into Trucks to the needy customers.

**FIGURE 2.10: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT
PRODUCTION PLAN AND SECTIONS**



Source: Approved Mining Plan

Conceptual Mining Plan/ Final Mine Closure Plan

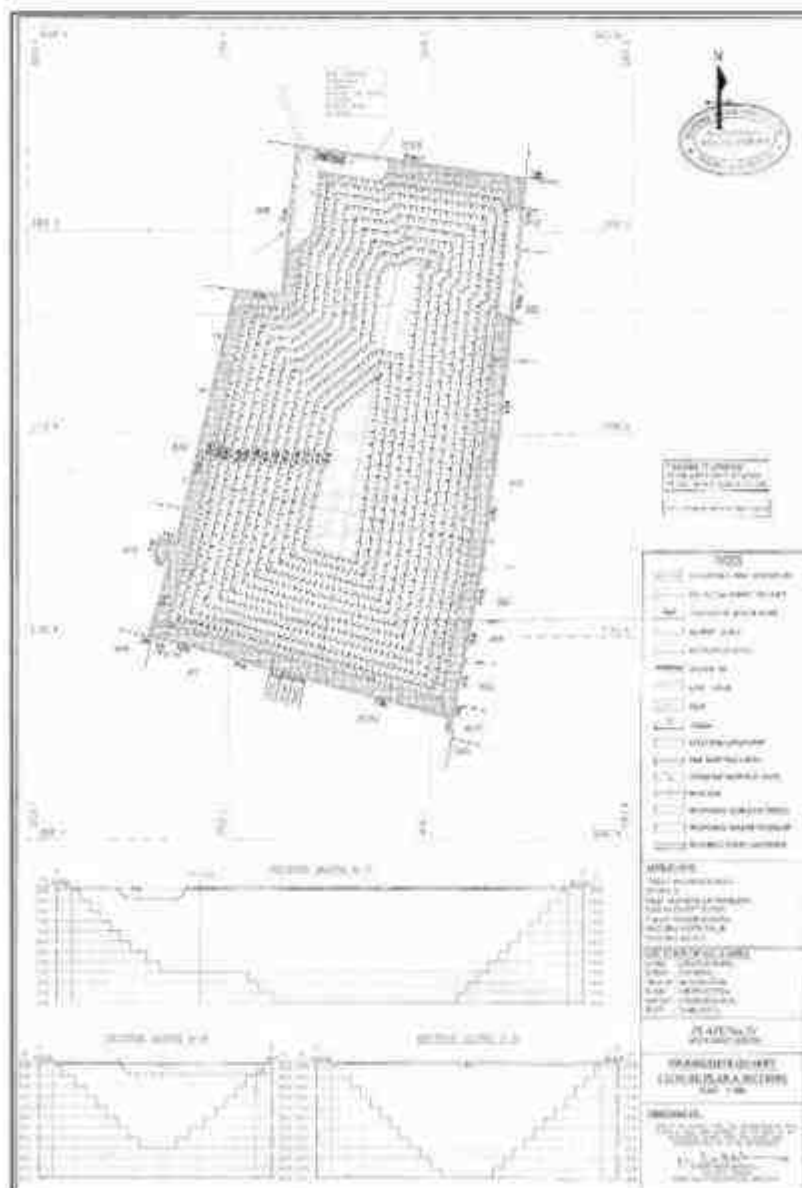
The ultimate pit size is designed based on certain practical parameters such as economical depth of mining, safety zones, permissible area, etc.

TABLE 2.8: ULTIMATE PIT DIMENSION

	Length (Max) (m)	Width (Max) (m)	Depth (Max)
XY-AB	63	107	42m
XY-CD	181	133	57m

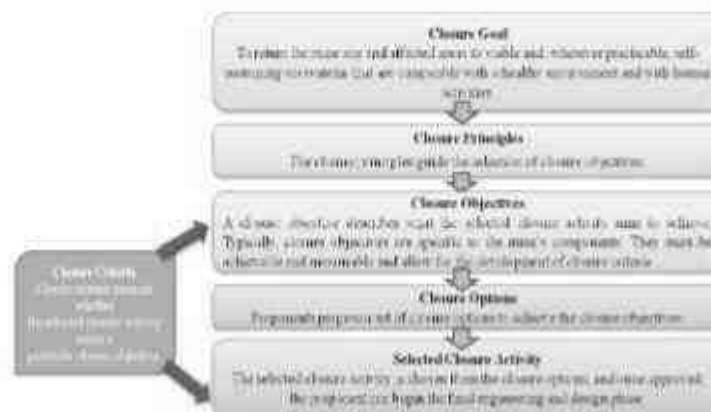
Source: Approved Mining Plan

FIGURE 2.11: CLOSURE PLAN AND SECTIONS



Source: Approved Mining Plan

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

Closure Objectives –

- Access to be limited, for the safety of humans and wildlife.
- The open pit mine workings and pit boundary are physically and geo-technically stable.
- Water quality in flooded pits is safe for humans, aquatic life, and wildlife.
- Discharge of contaminated drainage has been minimized and controlled.
- Original or desired new surface drainage patterns have been established.
- For flooded pits, in-pit aquatic habitat has been established where practical and feasible.
- Emergency access and escape routes from flooded pits for humans and wildlife are in place.
- Dust levels are safe for people, vegetation, aquatic life, and wildlife.

Closure Planning & Options Considerations in Mine Design –

- The closure of mine is well planned at the initial stage of planning & design consideration by the internal and external stakeholders
- Construction of 2m height bund all along the mine pit boundary and ensure its stability all time & construction of garland drain along the natural slope to avoid sliding and collection of soil to the pit & surface runoff during rainfall
- After complete exploitation of mineral, the lowest bench foot wall side will be maintained as plain surface without any sump pits to avoid any accidents

- All the sharp edges will be dressed to smoother face before the closure of mine and ensure no loose debris on hanging wall side
- The project proponent as a part of social responsibilities assures to supply the stored mine pit water to the nearby villages after effective treatment process as per the standards of TNPCB & TWAD
- Native species will be planted in 3 row patterns on the boundary barriers and 1st bench, a full-time sentry will be appointed at the gate to prevent inherent entry of public & cattle.
- The access road to the quarry will be cut-off immediately after the closure
- The layout design shall be prepared and get approved from Department of Geology and Mining
- The proponent is instructed to construct as per the layout approved
- Physical and chemical stability of structures left in place at the site, the natural rehabilitation of a biologically diverse, stable environment, the ultimate land use is optimized and is compatible with the surrounding area and the requirements of the local community, and taking the needs of the local community into account and minimizing the socio-economic impact of closure
- There will be a positive change in the environmental and ecology due to the mine closure

2.5 METHOD OF MINING

Opencast Mechanized Mining Method is proposed by formation of 5.0-meter height bench with a bench width not less than the bench height. Bench slope will be maintained as 60°.

The Rough Stone is a batholith formation and the splitting of rock mass of considerable volume from the parent rock mass will be carried out by deploying jackhammer drilling and Slurry Explosives will be used for blasting. Hydraulic Excavator attached with rock breaker/ bucket with tipper combination will be involved for the excavation/breaking of rough stone after blasting. Hydraulic excavators attached with bucket unit will be deployed for loading the Rough Stone into the tippers and then the stone is transported from pithead to the nearby crushers.

It is recommended to obtain necessary statutory permission from the Department of Geology and Mining for Using Heavy Earth Moving Machineries, Blasting and appointment of Mines Manager etc.,

2.5.1 Drilling & Blasting Parameters

Drilling will be carried out using Jack hammer and compressor, the depth of the hole will be maximum 1.5m. Drilling & Blasting will be carried out as per parameters given below: -

Spacing	-	1.2m
Burden	-	1.0 m
Depth of hole	-	1.5 m
Charge per hole	-	0.50 – 0.75kg
Powder factor	-	6.0 tonnes/kg
Diameter of hole	-	32 mm
Production Capacity	=	493m ³ of Rough stone per day
Spacing X Burden X Depth	=	1.2m X 1.0m X 1.5m = 1.8m ³ = 1.8m ³ X 2.75 (Bulk Density) = 4.95Ts per hole

hence for the production of 493m^3 (1355Ts) = 273Nos of holes to be drilled per day

Explosives per hole = $\frac{1}{4}$ kg hence 136kg of Explosives will be utilized maximum considering the peak production

Type of Explosives to be used –

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

Storage of Explosives

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

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

2.5.2 Extent of Mechanization

TABLE 2.9: PROPOSED MACHINERY DEPLOYMENT

S.NO.	TYPE	NOS	SIZE/CAPACITY	MOTIVE POWER
1	Hand Jack hammer	4	1.2m to 2.0m	Compressed air
2	Compressor	1	400psi	Diesel Drive
3	Wagon Drill Machine	1	60HP	Diesel Drive
4	Excavator with Bucket and Rock Breaker	2	300 HP	Diesel Drive
5	Trucks	5	30 Tonnes	Diesel Drive
6	Water Sprinkler	1	4000 ltrs	Diesel Drive

Source: Approved Mining Plan

2.6 GENERAL FEATURES

2.6.1 Existing Infrastructures

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

2.6.2 Drainage Pattern

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

2.6.3 Traffic Density

The traffic survey conducted based on the transportation route of material, the Rough Stone is proposed to be transported mainly through

Traffic density measurements were performed at two locations and given below in table no. 2.10.

Traffic density measurement was made continuously for 24 hours by visual observation and counting of vehicles under three categories, viz., Heavy motor vehicles, light motor vehicles and two/three wheelers. As traffic densities on the

roads are high, two skilled persons were deployed simultaneously at each station during each shift- one person on either direction for counting the traffic. At the end of each hour, fresh counting and recording was undertaken.

TABLE.2.10: TRAFFIC SURVEY LOCATIONS

Station Code	Road Name	Distance and Direction	Type of Road
TS-1	Kallurani-Aladipatti Panchayat Road	1.9km NE	Kallurani-Aladipatti Panchayat Road
TS-2	District Road	1.8	District Road

Source: On-site monitoring by GEMS FAE & TM

TABLE 2.11: EXISTING TRAFFIC VOLUME

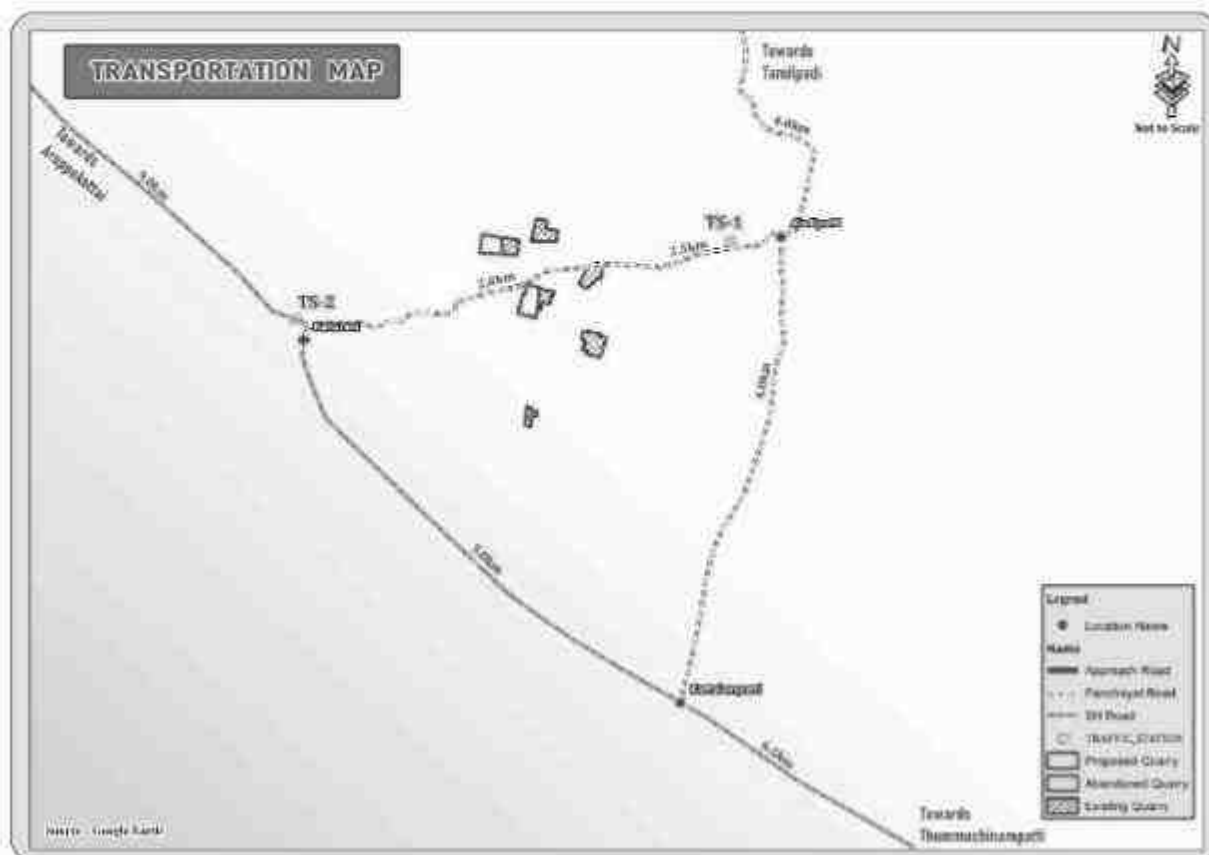
Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	20	60	30	30	100	50	140
TS2	60	180	60	60	300	150	390

Source: On-site monitoring by GEMS FAE & TM

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

TABLE 2.12: ROUGH STONE & GRAVEL HOURLY TRANSPORTATION REQUIREMENT

Transportation of Rough Stone & Gravel per day		
Capacity of trucks	No. of Trips per day	Volume in PCU
20 tonnes	41	123

FIGURE.2.12: MINERAL TRANSPORTATION ROUTE MAP**TABLE 2.13: 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 – 1960 guidelines
TS1	140	123	263	1200
TS2	390	123	513	1500

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

- Due to these projects the existing traffic volume will not exceed
- As per the IRC 1960 this existing village road can handle 1200 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.

2.6.4 Mineral Beneficiation and Processing

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

2.7 PROJECT REQUIREMENT

2.7.1 Water Source & Requirement

Detail of water requirements in KLD as given below:

TABLE 2.14: WATER REQUIREMENT FOR THE PROJECT

Purpose	Quantity	Source
Dust Suppression	0.9KLD	From the existing pit or from the water vendors
Green Belt	0.8KLD	From the existing pit or from the water vendors
Sanitation & Drinking	0.7KLD	From the existing pit or from the water vendors.
Total	2.4KLD	

Source: Prefeasibility report

2.7.2 Power and Other Infrastructure Requirement

Power is not required for the mining operation; the mining operation will be carried out using Diesel Generator and Earth moving machineries using diesel. The quarrying activity is proposed during day time only (General Shift 8 AM – 5 PM, Lunch Break 1 PM – 2 PM). Electricity for use in office and other internal infrastructure will be obtained from TNEB by project proponent.

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

2.7.3 Fuel Requirement

The proposed quarrying activity requires HSD (High Speed Diesel) for machineries as per below quantum-

Rough stone:

Per hour Excavator will consume = 16 liters / hour
 Per hour Excavator will excavate = 20m³ of Rough stone
 Rough stone quantity = 7,40,985/20 = 37049hours
 Diesel consume = 37049hours x 16 liters
 Total diesel consumption = 5,92,784 Liters of HSD will be utilized for Rough stone
 Total diesel consumption = 5,92,784 Liters of HSD will be utilized for entire project life.

2.7.4 Project Cost

The Environmental Management plan has been prepared considering the mode of working, Safety of the employees and Monitoring periods the total Cost is Rs.3,46,66,000/.

2.8 EMPLOYMENT REQUIREMENT:

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

TABLE 2.15: PROPOSED MANPOWER DEPLOYMENT

Designation	No of persons
a) Supervisory Category	
Mines Manager	1

Geologist	1
b) Skilled Labour	
Mines Foreman	1
Mate/Blaster	1
Excavator Operator	2
Wagon Drill Operator	1
Truck driver	5
Water sprinkler Driver	1
Jack hammer operator	8
c) Unskilled labour	
Security	1
Labour & Helper	4
Cleaner & Co-operator	8
Total	34

Source: Approved Mining Plan & Pre-Feasibility report.

2.9 PROJECT IMPLEMENTATION SCHEDULE

The mining operation will commence after the grant of Environmental Clearance, Consent to operate (CTO), Execution of Lease Deed and Obtaining permission from the DGMS (Notice of Opening).

TABLE 2.16: EXPECTED TIME SCHEDULE

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

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

3. DESCRIPTION OF ENVIRONMENT

3.0 GENERAL

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 **December 2025 - February 2026** by CHENNAI METTEX LAB PRIVATE LIMITED with CPCB guidelines for the following attributes-

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

Environmental data has been collected with reference to cluster quarries by CHENNAI METTEX LAB PRIVATE LIMITED

Study Area

An area of 10 km radius (aerial distance) from the periphery of the cluster is considered for EIA study. The study area has been divided into two zones viz **core zone** and **buffer zone**.

- Core zone is considered as cluster area
- Buffer zone taken as 10km radius from the periphery of the Cluster. Both Core zone and Buffer zone is taken as the study area.

Study Period

The baseline study was conducted during the Post monsoon season i.e., **December 2025 - February 2026**

Study Methodology

- The project area was surveyed in detail with the help of Total Station Survey instruments and pillars were marked. The boundary coordinates were superimposed on the satellite imagery to understand the relief of the area, besides Land use pattern of the area was studied through the Bhuvan (ISRO)
- Soil samples were collected and analysed for relevant physio-chemical characteristics in order to assess the impact due to mining activities and to recommend saplings for Greenbelt development.
- Ground water samples were collected from the existing bore wells, Surface water was collected from water bodies in the buffer zone and analysed as per CPCB Guidelines.
- An onsite meteorological station was setup in cluster area, to collect data about wind speed, wind direction, temperature, relative humidity, rainfall and general weather conditions were recorded throughout the study period.
- Air quality Data were collected by installation of Respiratory Dust Samplers (RDS) for Fugitive dust, PM₁₀ and SO₂, NO_x with gaseous attachments & Fine Dust Samplers (FDS) for PM_{2.5} and other parameters as per NAAQ norms and analysed for primary air pollutants to work out the existing status of air quality.

- The Noise level measurements were also made at various locations in different intervals of time with the help of sound level meter to establish the baseline noise levels in the impact zone.
- Baseline biological studies were carried out to assess the ecology of the study area to study the existing flora and fauna pattern of the area.
- Socio-Economic survey was conducted at village and household level in the study area to understand the present socio-economic conditions and assess the extent of impact due to the proposed mining project. The sampling methodologies for the various environmental parameters required for the study, frequency of sampling, method of samples analysis, etc., are given below Table 3.1.

TABLE 3.1: MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING

Attribute	Parameters	Frequency of Monitoring	No. of Locations	Protocol
Land-use Land cover	Land-use Pattern within 10 km radius of the study area	Data from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio-Chemical Characteristics	Once during the study period	6 (1 core & 5 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (2 surface water & 4 Ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
*Ambient Air Quality	PM10 PM2.5 SO2 NOX Fugitive Dust	24 hourlies twice a week (December 2025 - February 2026)	7 (2 core & 5 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
*Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	7(2 core & 5 buffer zone)	IS 9989 As per CPCB Guidelines
Ecology	Existing Flora and Fauna	Through field visit during the study period	Study Area	Primary Survey by Quadrate & Transect Study Secondary Data -- Forest Working Plan
Socio Economic Aspects	Socio-Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

Source: On-site monitoring/sampling by CHENNAI METTEX LAB PRIVATE LIMITED in association with GEMS. * All monitoring and testing have been carried out as per the Guidelines of CPCB and MoEF& CC.

3.1 LAND ENVIRONMENT

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

3.1.1 Land Use/ Land Cover

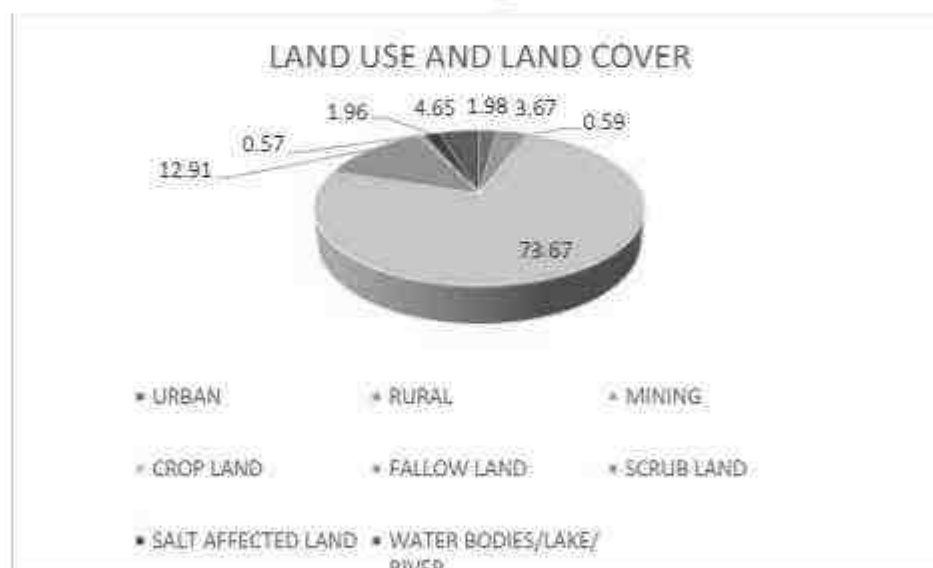
A visual interpretation technique has been adopted for land use classification based on the keys suggested in the chapter – V of the guidelines issued by NNRMS Bangalore & Level III classification with 1:50,000 scale for the preparation of land use mapping. Land use pattern of the area was studied through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

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

S.No	CLASSIFICATION	AREA_HA	AREA_%	AREA_HA	AREA_%
BUILTUP					
1	URBAN	711.5045	1.98	18.57	0.83
2	RURAL	1319.10	3.67	112.11	5.02
3	MINING	211.4902	0.59	152.59	6.84
AGRICULTURAL LAND					
4	CROP LAND	26473.39	73.67	1674.08	75.01
5	FALLOW LAND	4637.59	12.91	158.30	7.09
BARREN/WASTE LANDS					
6	SCRUB LAND	206.61	0.57	0.00	0.00
7	SALT AFFECTED LAND	704.18	1.96	0.00	0.00
WETLANDS/ WATER BODIES					
8	WATER BODIES/LAKE/ RIVER	1670.59	4.65	116.21	5.21
TOTAL		35934.45	100.00	2231.85	100.00

Source: Survey of India Toposheet and Landsat Satellite Imagery

FIGURE 3.3: PIE DIAGRAM OF LAND USE AND LAND COVER - 10KM RADIUS IN AREA_ %



From the Table No.3.2, Pie Diagram 3.1 and Land Use Map (Fig No.3.2) is inferred that the majority of the land in the study area is Agriculture land (includes crop land – 73.67% and Fallow land – 12.91%) range is 86.58% & in Build Up Land, mining area occupied 6.24%.

The total mining area within the study area is 211.49 ha i.e., 0.59%. The cluster area of 16.30.50 ha contributes about 7.7% of the total mining area within the study area. This small percentage of Mining Activities shall not have any significant impact on the environment

3.1.2 Topography

The project area is almost plain terrain having gentle slope towards South East side and the quarry was surrounded by an expire & an existing quarry on South East side.

3.1.3 Drainage Pattern of the Area

The drainage pattern of the area is dendritic – sub dendritic. Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin. They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land. There are no streams, canals or water bodies crossing within the project area.

3.1.4 Seismic Sensitivity

The proposed project site falls in the seismic Zone II, least active zone as per BMTPC, Vulnerability Atlas of Seismic zone of India IS: 1893 – 2002. The project area falls in the hard rock terrain on the peninsular shield of south India which is highly stable.

3.1.5 Environmental Features in the Study Area

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

TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER

SLNo	Sensitive Ecological Features	Name	Arial Distance in km from Cluster
1	National Park / Wild life Sanctuaries	Kanjirankulam Birds Sanctuary Chitrangudi Bird Sanctuary	34.5km - SE 35.5km - SE
2	Reserved Forest	Vidathakulam R.F	15.3km-NE
3	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10km Radius
4	Critically Polluted Areas	None	Nil within 10km Radius
5	Mangroves	None	Nil within 10km Radius
6	Mountains/Hills	None	Nil within 10km Radius
7	Notified Archaeological Sites	None	Nil within 10km Radius
8	Industries/ Thermal Power Plants	None	Nil within 10km Radius
9	Defence Installation	None	Nil within 10km Radius

Source: Survey of India Toposheet

TABLE 3.4: NEARBY WATER BODIES FROM THE PROPOSED PROJECT SITE

SLNo	NAME	DISTANCE & DIRECTION
1	Odai	20m SE
2	Odai	90m East
3	Sundakollai Kanmoi	300m South
4	Tank	350m North
5	Tank	1.5km NE
6	Gundar River	6km NE

Source: Village Cadastral Map and Field Survey

3.1.6 Soil Environment

Soil quality of the study area is one of the important components of the land environment. The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are detailed in Table 3.5 and Figure 3.4.

The objective of the soil sampling is -

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

TABLE 3.5: SOIL SAMPLING LOCATIONS

S.No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Core Zone	Project Area	9°28'22.71"N 78°10'50.21"E
2	S-2	Near Existing Quarry (Barren Land)	400m NE	9°28'33.19"N 78°11'2.91"E
3	S-3	Muthuramalingapuram (Barren Land)	1.3km SW	9°27'51.21"N 78°10'10.00"E
4	S-4	Aladipatti (Barren Land)	1.8km NE	9°28'39.05"N 78°11'53.46"E
5	S-5	M.Reddyapatti (Agriculture Land)	5.5km SE	9°25'50.52"N 78°12'35.75"E
6	S-6	Savasapuram (Agriculture Land)	4.0km West	9°28'54.35"N 78° 8'37.36"E

Source: On-site monitoring/sampling by CHENNAI METTEX LAB PRIVATE LIMITED in association with GEMS.

Methodology –

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the project site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Six (6) locations were selected for soil sampling on the basis of soil types, vegetative

cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.6.

TABLE 3.6: METHODOLOGY OF SAMPLING COLLECTION

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

Source: On-site monitoring/sampling by CHENNAI METTEX LAB PRIVATE LIMITED in association with GEMS.

Soil Testing Result –

The samples were analysed as per the standard methods prescribed in “Soil Chemical Analysis (M.L. Jackson, 1967) & Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India”. The important properties analysed for soil are bulk density, porosity, infiltration rate, pH and Organic matter, kjeldahi Nitrogen, Phosphorous and Potassium. The standard classifications of soil are presented below in Figure 3.4 and the physico-chemical characteristics of the soil & Test Results in Table 3.7.

FIGURE 3.4: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS

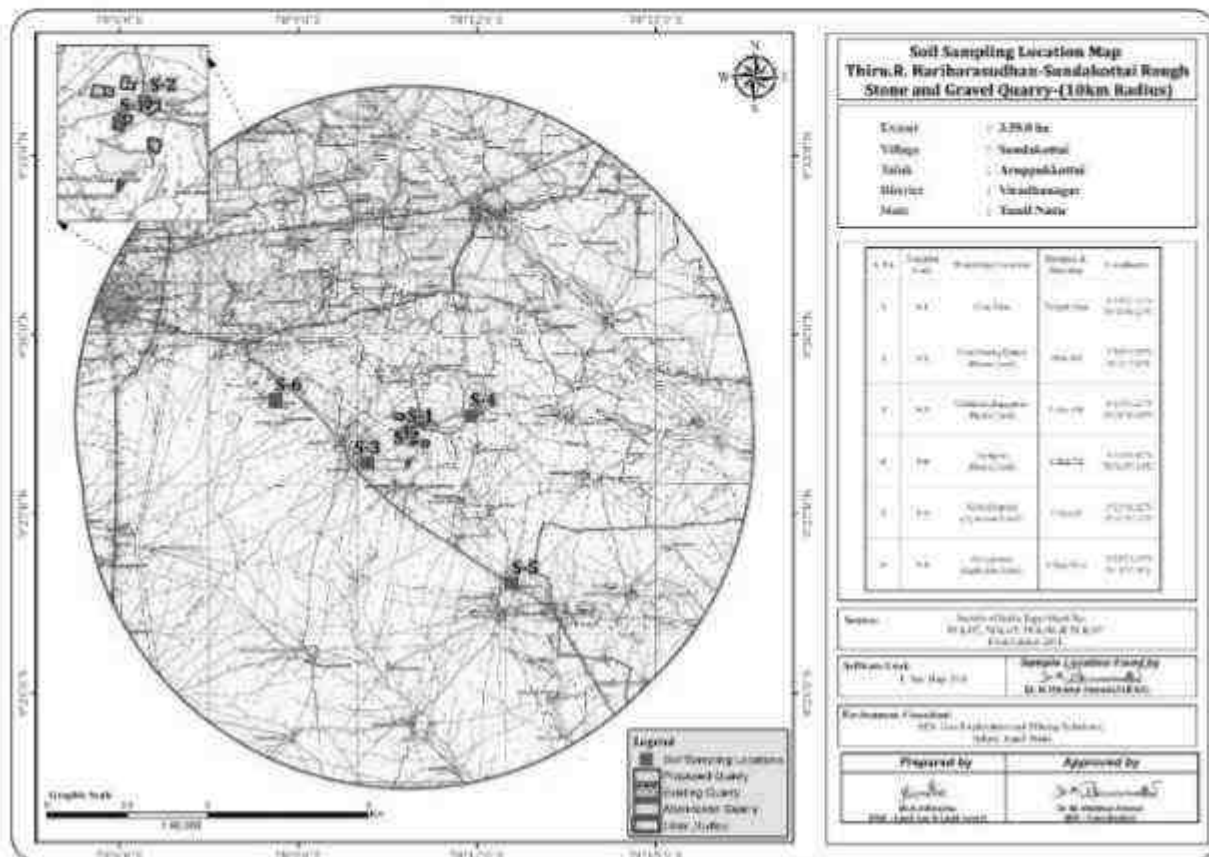


FIGURE 3.5: SOIL MAP

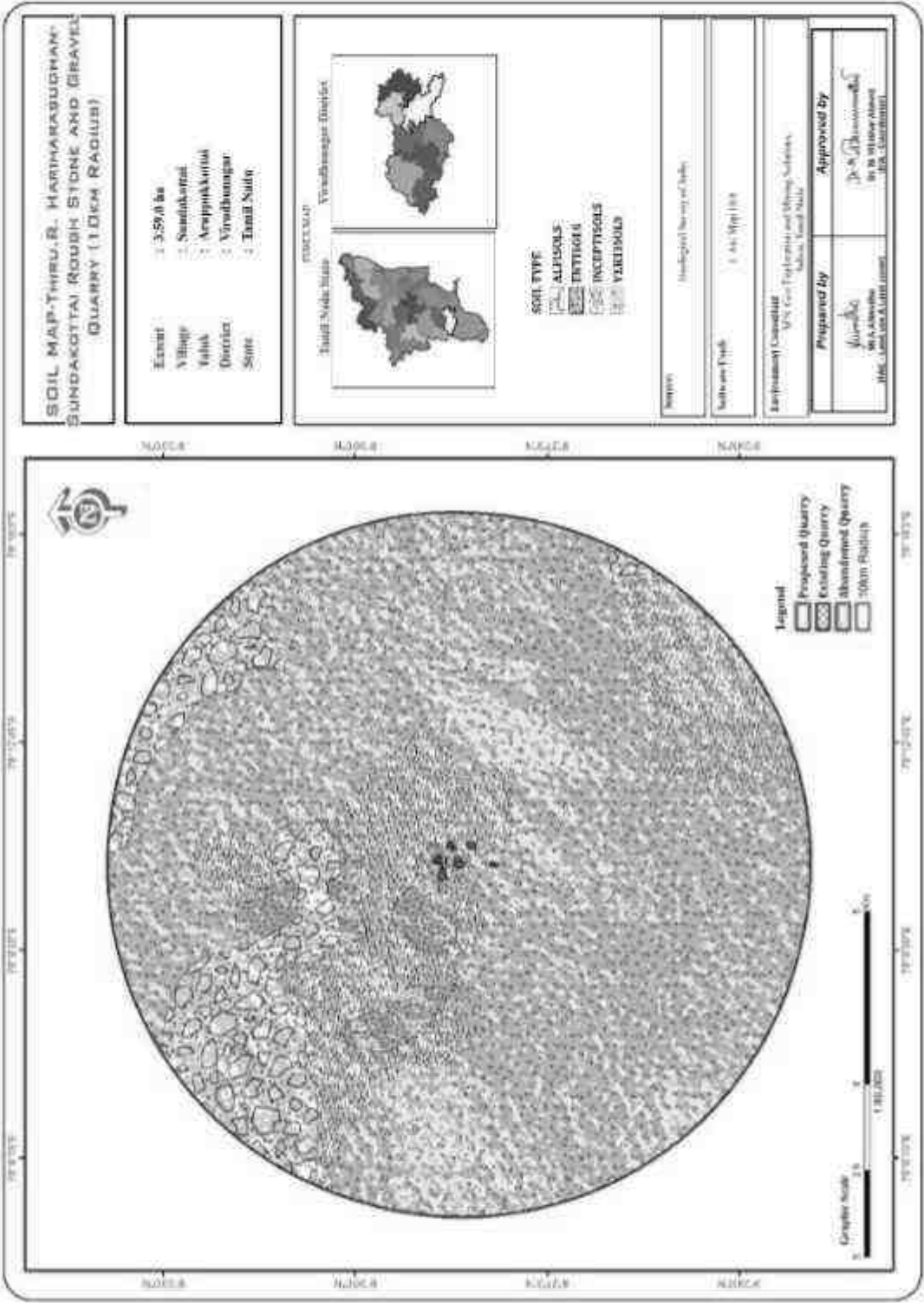


TABLE 3.7: SOIL QUALITY OF THE STUDY AREA

S. No	Test Parameters	Protocols	S1	S2	S3	S4	S5	S6
01	pH @ 25°C	IS 2720 Part 26 - 1987 (Reaff.2016)	6.89	6.24	6.21	5.64	5.33	5.67
02	Conductivity @ 25°C	IS 14767 - 2000 (Reaff. 2016)	268 µmhos/cm	327 µmhos/cm	212.0 µmhos/cm	312.0 µmhos/cm	294.0 µmhos/cm	299 µmhos/cm
03	Texture :							
	Clay	Gravimetric Method	30.3 %	28.3 %	28.9 %	29.0 %	30.2 %	31.0 %
	Sand		36.9 %	37.9 %	38.6 %	37.2 %	37.9 %	36.9 %
	Silt		32.8 %	33.8 %	32.5 %	33.8 %	31.9 %	32.1 %
04	Water Holding Capacity	By Gravimetric Method	40.5 %	48.3 %	42.5 %	42.2 %	40.6 %	39.9 %
05	Bulk Density	By Cylindrical Method	1.03 g/cm³	1.20 g/cm³	1.06 g/cm³	1.13 g/cm³	1.01 g/cm³	1.04 g/cm³
06	Porosity	By Gravimetric Method	38.5 %	46.2 %	38.7 %	40.3 %	39.2 %	37.8 %
07	Calcium as Ca	USEPA 3050 B - 1996 & USEPA 6010 C - 2000	57.8 mg/kg	65.7 mg/kg	62.5 mg/kg	64.6 mg/kg	63.2 mg/kg	53.6 mg/kg
08	Magnesium as Mg		2.6 mg/kg	24.9 mg/kg	31.8 mg/kg	31.6 mg/kg	29.5 mg/kg	26.4 mg/kg
09	Manganese as Mn		23.3 mg/kg	26.8 mg/kg	25.6 mg/kg	22.7 mg/kg	24.8 mg/kg	17.9 mg/kg
10	Zinc as Zn	APHA 23 rd Edn 2019 4500 ClB	1.17 mg/kg	3.60 mg/kg	3.25 mg/kg	4.56 mg/kg	2.23 mg/kg	3.4 mg/kg
11	Boron as B		1.18 mg/kg	1.22 mg/kg	1.85 mg/kg	2.74 mg/kg	1.05/kg	1.24 mg/kg
12	Chloride as Cl		174.0 mg/kg	88.9 mg/kg	98.8 mg/kg	162.0 mg/kg	106 mg/kg	7.8 mg/kg
13	Total Soluble Sulphate as SO ₄	IS 2720 Part 27 : 1977 (Reaff.2015)	0.026 %	0.01 %	0.023 %	0.025 %	0.019 %	0.015 %
14	Potassium as K	USEPA 3050 B - 1996 & USEPA 6010 C - 2000	26.1 mg/kg	27.8 mg/kg	19.7 mg/kg	23.3 mg/kg	22.7 mg/kg	18.7 mg/kg
15	Total Phosphorus as P	IS 10158 : 1982 (Reaff. 2015)	1.39 mg/kg	2.15 mg/kg	4.65 mg/kg	3.56 mg/kg	2.61 mg/kg	1.09 mg/kg
16	Total Nitrogen as N	IS 14684 : 1999 (Reaff.2019)	289 mg/kg	267 mg/kg	365.0 mg/kg	323.4 mg/kg	362.8 mg/kg	325.7 mg/kg
17	Cadmium as Cd	USEPA 3050 B - 1996 & USEPA 6010 C - 2000	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
18	Total Chromium as Cr		BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)

19	Copper as Cu	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
20	Lead as Pb	1.23 mg/kg	1.02 mg/kg	1.13 mg/kg	1.03 mg/kg	1.97 mg/kg
21	Iron as Fe	6.63 mg/kg	6.18 mg/kg	6.98 mg/kg	5.21 mg/kg	6.03 mg/kg
22	Organic Matter	IS : 2720 Part 22: 1972 (Reaff. 2015)	2.27 %	2.21 %	2.08 %	3.46 %
23	Organic Carbon	IS : 2720 Part 22: 1972 (Reaff. 2015)	1.32 %	1.28 %	1.21 %	2.01 %
24	Cation Exchange Capacity	USEPA 9080 – 1996	26.9 meq/100g of soil	26.7 meq/100g of soil	21.9 meq/100g of soil	42.1 meq/100g of soil
						21.1 meq/100g of soil
						17.7 meq/100g of soil

Source: Sampling Results by CHENNAI METTEX LAB PRIVATE LIMITED in association with GEMS

Interpretation & Conclusion

Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is Clay varied between 28.3-31.0%, Sand varied between 36.9-38.6% and Silt varied between 31.9-33.8% and Bulk Density of Soils in the study area varied between 1.01-1.20/cm³. The Water Holding Capacity of the soil samples is found to be medium i.e., ranging from 39.9-48.3%.

Chemical Characteristics

- The nature of soil is slightly alkaline to strongly alkaline with pH range 5.33-6.89
- The available Nitrogen content range between 267-365 mg/kg
- The available Phosphorus content range between 5.33-6.89 mg/kg
- The available Potassium range between 18.7-27.8 mg/kg

3.2 WATER ENVIRONMENT

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

3.2.1 Surface Water Resources:

Sundakottai Kanmoi is the major surface water body in the study area and the rainfall over the area is moderate, the rainwater storage in open wells and trenches are in practice over the area and the stored water acts as source of drinking water for few months after rainy season.

3.2.2 Ground Water Resources:

Groundwater occurs in all the crystalline formations of oldest Achaeans and Recent Alluvium. The occurrence and behaviour of groundwater are controlled by rainfall, topography, geomorphology, geology, structures etc., The weathering is controlled by the intensity of weathering and fracturing. Dug wells as wells as bore wells are more common ground water abstraction structures in the area. The diameter of the dug well is in the range of 7 to 10 m and depth of dug wells range from 7.2 to 13 m bgl. The dug wells yield up to 1 lps in summer months and few wells remains dry. The yield is adequate for irrigation for one or two crops in monsoon period.

3.2.3 Methodology

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

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

Two (2) surface water and Four (4) ground water samples were collected from the study area and were analysed for physio-chemical, heavy metals and bacteriological parameters in order to assess the effect of mining and other activities on surface and ground water. The samples were analysed as per the procedures specified by CPCB, IS-10500:2012 and 'Standard methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA). The water sampling locations are given in Table 3.8 and shown as Figure 3.6.

TABLE 3.8: WATER SAMPLING LOCATIONS

S.NO	CODE	LOCATIONS	DISTANCE & DIRECTION	CO-ORDINATES
SURFACE WATER				
1	SW-1	Sundakottai Kanmoi	300m South	9°28'8.14"N 78°10'50.07"E
2	SW-2	Tank Near Aladipatti	1.8km NE	9°28'50.35"N 78°11'45.68"E
GROUND WATER				
3	OW-1	Near Project Area	160m West	9°28'23.35"N 78°10'42.91"E
4	OW-2	Muthuramalingapuram	1.2km SW	9°27'54.15"N 78°10'13.79"E
5	BW-1	Near Project Area	80m South	9°28'16.27"N 78°10'48.87"E
6	BW-2	M Reddyapatti	5.0km SE	9°26'2.34"N 78°12'31.46"E

Source: On-site monitoring/sampling by CHENNAI METTEX LAB PRIVATE LIMITED in association with GEMS

TABLE 3.9: SURFACE WATER SAMPLING RESULTS

TEST	TEST METHOD	UNIT	SW1- Sundakottai Kammoi	SW2- Tank Near Akadipatti
Discipline: Chemical				
Colour	IS 3025 Part 4:1983 (Reaff:2017)	Hazen	5 Hazen	5 Hazen
Odour	IS 3025 Part 5:2018	-	Agreeable	Agreeable
pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	-	8.05	7.81
Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	µmhos/cm	1214.0 µmhos/cm	1152.0 µmhos/cm
Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	NTU	3 NTU	5 NTU
Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	mg/l	704.0 mg/l	668.0 mg/l
Total Hardness as CaCO ₃	IS 3025 Part 21:2009 (Reaff:2019)	mg/l	224.0 mg/l	208.0 mg/l
Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	mg/l	52.9 mg/l	48.0 mg/l
Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	mg/l	22.3 mg/l	21.4 mg/l
Total Alkalinity as CaCO ₃	IS 3025 Part 23:1986 (Reaff:2019)	mg/l	202.4 mg/l	187.8 mg/l
Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	mg/l	245.6 mg/l	216.8 mg/l
Sulphate as SO ₄	IS 3025 Part 24:1986 (Reaff:2019)	mg/l	42.6 mg/l	53.1 mg/l
Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	mg/l	0.5 mg/l	0.39 mg/l
Residual Free Chlorine	IS 3025 Part 26:1986 (Reaff:2019)	mg/l	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)
Fluoride as F	APHA 23 rd Edn. 2017:4.500 F, D	mg/l	0.47 mg/l	0.28 mg/l
Nitrate as NO ₃	IS 3025 Part 34:1988 (Reaff:2019)	mg/l	18.3 mg/l	14.1 mg/l
Copper as Cu	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
Manganese as Mn	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
Mercury as Hg	USEPA 200.8	mg/l	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
Cadmium as Cd	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)
Selenium as Se	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
Aluminium as Al	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
Lead as Pb	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
Zinc as Zn	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)
Total Chromium as Cr	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)

Boron as B	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL: 0.05 mg/l)	BDL (DL: 0.05 mg/l)
Mineral Oil	IS 3025 Part 39:1991 (Reaff: 2019)	mg/l	BDL (DL: 0.01 mg/l)	BDL (DL: 0.01 mg/l)
Phenolic compounds as C ₆ H ₅ OH	IS 3025 Part 43:1992 (Reaff: 2019)	mg/l	BDL (DL: 0.0005 mg/l)	BDL (DL: 0.0005 mg/l)
Anionic Detergents (as MBAS)	IS 13428 - 2005 (Reaff:2019) (Annex K)	mg/l	BDL (DL: 0.01 mg/l)	BDL (DL: 0.01 mg/l)
Cyanide as CN	IS 3025 Part 27:1986 (Reaff: 2019)	mg/l	BDL (DL: 0.01 mg/l)	BDL (DL: 0.01 mg/l)
BOD @ 27°C for 3 days	IS 3025 Part 44:1993 (Reaff:2019)	mg/l	16.1 mg/l	13.2 mg/l
Chemical Oxygen Demand	IS 3025 Part 58:2006 (Reaff:2017)	mg/l	54.2 mg/l	40.2 mg/l
Dissolved Oxygen	IS 3025 Part 38:1989 (Reaff:2019)	mg/l	7.7 mg/l	7.7 mg/l
Barium as Ba	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL: 0.05 mg/l)	BDL (DL: 0.05 mg/l)
Ammonia (as total ammonia-N)	IS 3025 Part 34:1988 (Reaff: 2019)	mg/l	BDL (DL: 0.01 mg/l)	BDL (DL: 0.01 mg/l)
Sulphide as H ₂ S	IS 3025 Part 29:1986 (Reaff: 2019)	mg/l	BDL (DL: 0.01 mg/l)	BDL (DL: 0.01 mg/l)
Molybdenum as Mo	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL: 0.02 mg/l)	BDL (DL: 0.02 mg/l)
Total Arsenic as As	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL: 0.005 mg/l)	BDL (DL: 0.005 mg/l)
Total Suspended Solids	IS 3025 Part 17:1984 (Reaff:2017)	mg/l	18.3 mg/l	28.4 mg/l
Discipline: Biological				
Total Coliform	APHA 23 rd Edn, 2017:9221F	MPN/100ml	1128 MPN/100ml	1121 MPN/100ml
<i>Escherichia coli</i>	APHA 23 rd Edn, 2017:9221F	MPN/100ml	224 MPN/100ml	129 MPN/100ml

Source: On-site monitoring/sampling by CHENNAI METTLEX LAB PRIVATE LIMITED in association with GEMS

TABLE 3.10: GROUND WATER SAMPLING RESULTS

TEST	PROTOCOL	Unit	OW1 - Near Project Area	OW2 - Madhuramalingapuram	BW1 - Near Project Area	BW2 - M Reddyapatti
Discipline: Chemical						
Colour	IS 3025 Part 4:1983 (Reaff:2017)	-	5	5 Hazen	5 Hazen	5 Hazen
Odour	IS 3025 Part 5:2018	-	Agreeable	Agreeable	Agreeable	Agreeable
pH at 25°C	IS 3025 Part 11:1983 (Reaff:2017)	-	7.63	7.54	7.23	7.18
Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff:2019)	µmhos/cm	1097.0 µmhos/cm	1001.5 µmhos/cm	892.0 µmhos/cm	924.5 µmhos/cm
Turbidity	IS 3025 Part 10:1984 (Reaff:2017)	NTU	1 NTU	2 NTU	1 NTU	1 NTU
Total Dissolved Solids	IS 3025 Part 16:1984 (Reaff:2017)	mg/l	647.0 mg/l	581.0 mg/l	517.0 mg/l	536.0 mg/l
Total Hardness as CaCO ₃	IS 3025 Part 21:2009 (Reaff:2019)	mg/l	192.4 mg/l	168.0 mg/l	156.0 mg/l	156.0 mg/l
Calcium as Ca	IS 3025 Part 40:1991 (Reaff:2019)	mg/l	46.4 mg/l	46.4 mg/l	36.6 mg/l	36.6 mg/l
Magnesium as Mg	IS 3025 Part 46:1994 (Reaff:2019)	mg/l	18.4 mg/l	18.4 mg/l	17.5 mg/l	17.5 mg/l
Total Alkalinity as CaCO ₃	IS 3025 Part 23:1986 (Reaff:2019)	mg/l	178.4 mg/l	141.2 mg/l	136.6 mg/l	132.0 mg/l
Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	mg/l	212.4 mg/l	189.7 mg/l	178.5 mg/l	175.5 mg/l
Sulphate as SO ₄	IS 3025 Part 24:1986 (Reaff:2019)	mg/l	47.5 mg/l	45.3 mg/l	37.7 mg/l	33.9 mg/l
Iron as Fe	IS 3025 Part 53:2003 (Reaff:2019)	mg/l	0.41 mg/l	0.32 mg/l	0.23 mg/l	0.30 mg/l
Residual Chlorine	IS 3025 Part 26:1986 (Reaff:2019)	mg/l	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)
Fluoride as F	APHA 23 rd Edn. 2017:4500 F.D	mg/l	0.37 mg/l	0.29 mg/l	0.21 mg/l	0.21 mg/l
Nitrate as NO ₃	IS 3025 Part 34:1988 (Reaff:2019)	mg/l	8.7 mg/l	6.8 mg/l	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)
Copper as Cu	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)

Manganese as Mn	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
Mercury as Hg	USEPA 2008	mg/l	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
Cadmium as Cd	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)
Selenium as Se	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
Aluminium as Al	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
Lead as Pb	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
Zinc as Zn	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)
Total Chromium as Cr	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
Boron as B	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)
Mineral Oil	IS 3025 Part 39:1991 (Reaff:2019)	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
Phenolic compounds as C ₆ H ₅ OH	IS 3025 Part 43:1992 (Reaff:2019)	mg/l	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
Aromatic Detergents (as MBAS)	IS 13428 - 2005 (Reaff:2019) (Annex K)	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
Cyanide as CN	IS 3025 Part 27:1986 (Reaff:2019)	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
Barium as Ba	IS 3025 Part 44:1993 (Reaff:2019)	mg/l	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)	BDL (DL:0.05 mg/l)
Ammonia (as total ammonia-N)	IS 3025 Part 58:2006 (Reaff:2017)	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
Sulphide as H ₂ S	IS 3025 Part 38:1989 (Reaff:2019)	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
Molybdenum as Mo	IS 3025 Part 65:2014 (Reaff:2019)	mg/l	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
Total Arsenic as As	IS 3025 Part 34:1988 (Reaff:2019)	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)

Total Suspended Solids	IS 3025 Part 29:1986 (Reaff: 2019)	mg/l	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)
Discipline: Biological					
Total Coliform	APHA 23 rd Edn. 2017:9221B	MPN/100ml	149 MPN/100ml	119 MPN/100ml	109 MPN/100ml
<i>Escherichia coli</i>	APHA 23 rd Edn. 2017:9221F	MPN/100ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml

Source: On-site monitoring/sampling by CHIENNAI METTLEX LAB PRIVATE LIMITED in association with GEMS

3.2.4 Interpretation & Conclusion

Surface Water

The pH varied from 7.81 – 8.05 while turbidity found within the standards (Optimal pH range for sustainable aquatic life is 6.5 to 8.5 pH).

Total Dissolved Solids:

Total Dissolved Solids varied from 668 – 704 mg/l, the TDS mainly composed of carbonates, bicarbonates, Chlorides, phosphates and nitrates of calcium, magnesium, sodium and other organic matter.

Other parameters:

Chloride content is 216.8 – 245.6 mg/l, Nitrates content is 14.1 – 18.3 mg/l and Sulphates varied from 42.6 – 53.1 mg/l.

Ground Water

The pH of the water samples collected ranged from 7.18 – 7.63 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. On Turbidity, the water samples meet the requirement. Total Dissolved Solids were found in the range of 517 – 647 mg/l in all samples. Total hardness varied between 156 – 192.4 mg/l for all samples.

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

3.2.5 Hydrology and Hydrogeological studies

The district is underlain by hard rock formation fissured and fractured crystalline rocks constitute the important aquifer systems in the district. Geophysical prospecting was carried out in that area by SSRMP-80 Instrument by qualified Geo physicist with the help of IGIS software and it was inferred that the low resistance encountered at the depth between 58-63m. The maximum depth proposed out of proposed projects is 42m BGL.

Ground water levels and Flow Direction based on the Bore well and open well Data's

In general, the ground water movement is based on the gradient i.e., water moves from the highest static ground water elevation to lowest static ground water elevation point. The ground water movement is important aspect to locating the recharge and discharge areas. Therefore, the data has been collected in the study area. Water level measured in the 8 open wells and 7 borewells.

The average water level in the open well is varies from = 10.7m to 12.9m bgl

The water level in the bore well is varies from = 60.4m to 62.5m bgl

The water level in the area is above 58m-63m hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area.

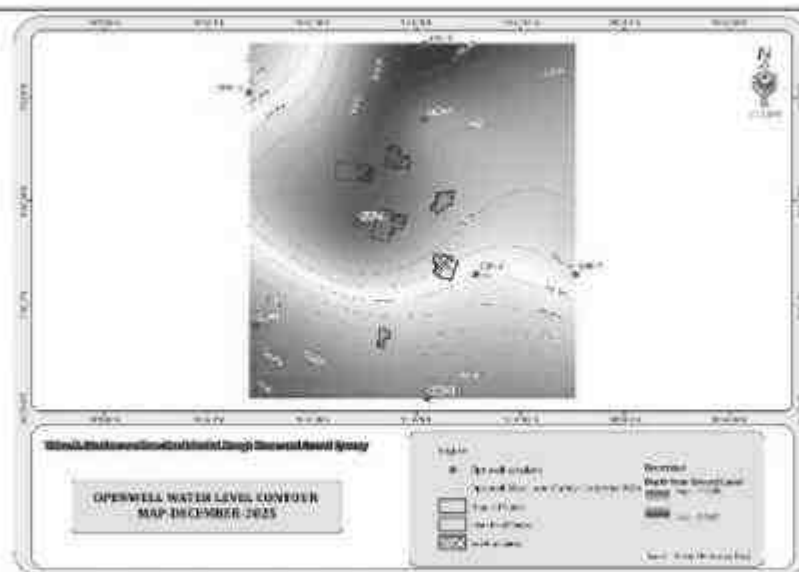
TABLE 3.11: PRE-MONSOON SEASON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

S.NO	LABEL	LONGITUDE	LATITUDE	Oct-25	Nov-25	Dec-25
1	OW-1	78° 10' 42.9304" E	9° 28' 23.3645" N	14.5	15.1	15.7
2	OW-2	78° 10' 13.7852" E	9° 27' 54.1508" N	15.6	16.2	16.8
3	OW-3	78° 10' 11.6292" E	9° 29' 01.3598" N	15.2	15.8	16.4
4	OW-4	78° 11' 02.3723" E	9° 28' 53.5406" N	14.8	15.4	16
5	OW-5	78° 11' 02.3582" E	9° 29' 15.3315" N	14.3	14.9	15.5
6	OW-6	78° 11' 17.0849" E	9° 28' 08.8731" N	15.1	15.7	16.3
7	OW-7	78° 11' 45.8146" E	9° 28' 08.8431" N	15	15.6	16.2
8	OW-8	78° 11' 03.0617" E	9° 27' 32.9841" N	15.6	16.2	16.8

Source: Onsite monitoring data

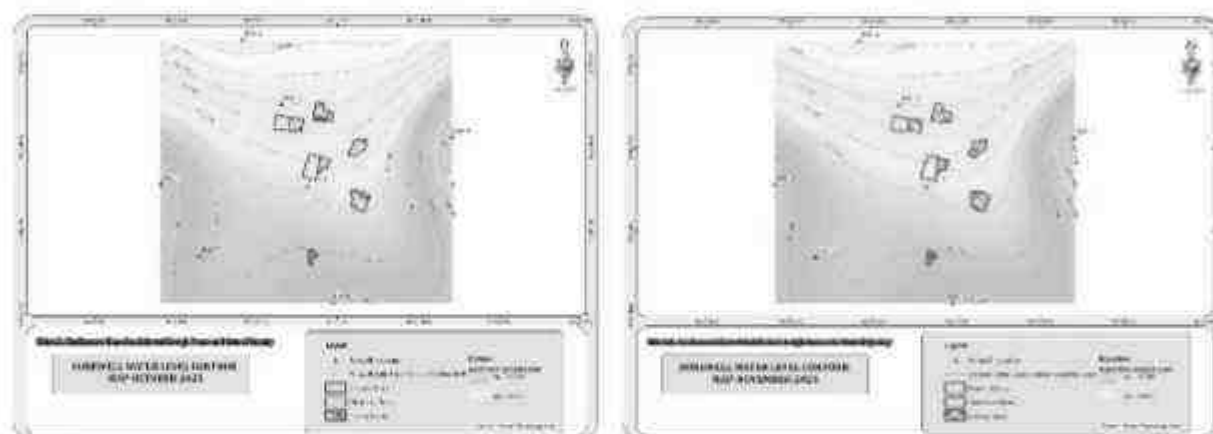
FIGURE 3.7: OPEN WELL CONTOUR MAP OCTOBER 2025 – DECEMBER 2025



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

S.No	Name	LONGITUDE	LATITUDE	Oct-25	Nov-25	Dec-25
1	BW1	78° 10' 48.8856" E	9° 28' 16.1921" N	116.8	117.4	118
2	BW2	78° 09' 54.5012" E	9° 28' 16.8591" N	117.1	117.7	118.3
3	BW3	78° 10' 39.2109" E	9° 28' 45.5808" N	116.5	117.1	117.7
4	BW4	78° 10' 24.7729" E	9° 29' 08.4912" N	116.2	116.8	117.4
5	BW5	78° 11' 42.2713" E	9° 28' 33.6958" N	117.4	118	118.6
6	BW6	78° 10' 58.5314" E	9° 27' 34.1836" N	117	117.6	118.2
7	BW7	78° 10' 09.0929" E	9° 27' 51.1208" N	116.9	117.5	118.1

Source: Onsite monitoring data

FIGURE 3.8: BOREWELL CONTOUR OCTOBER 2025 – DECEMBER 2025

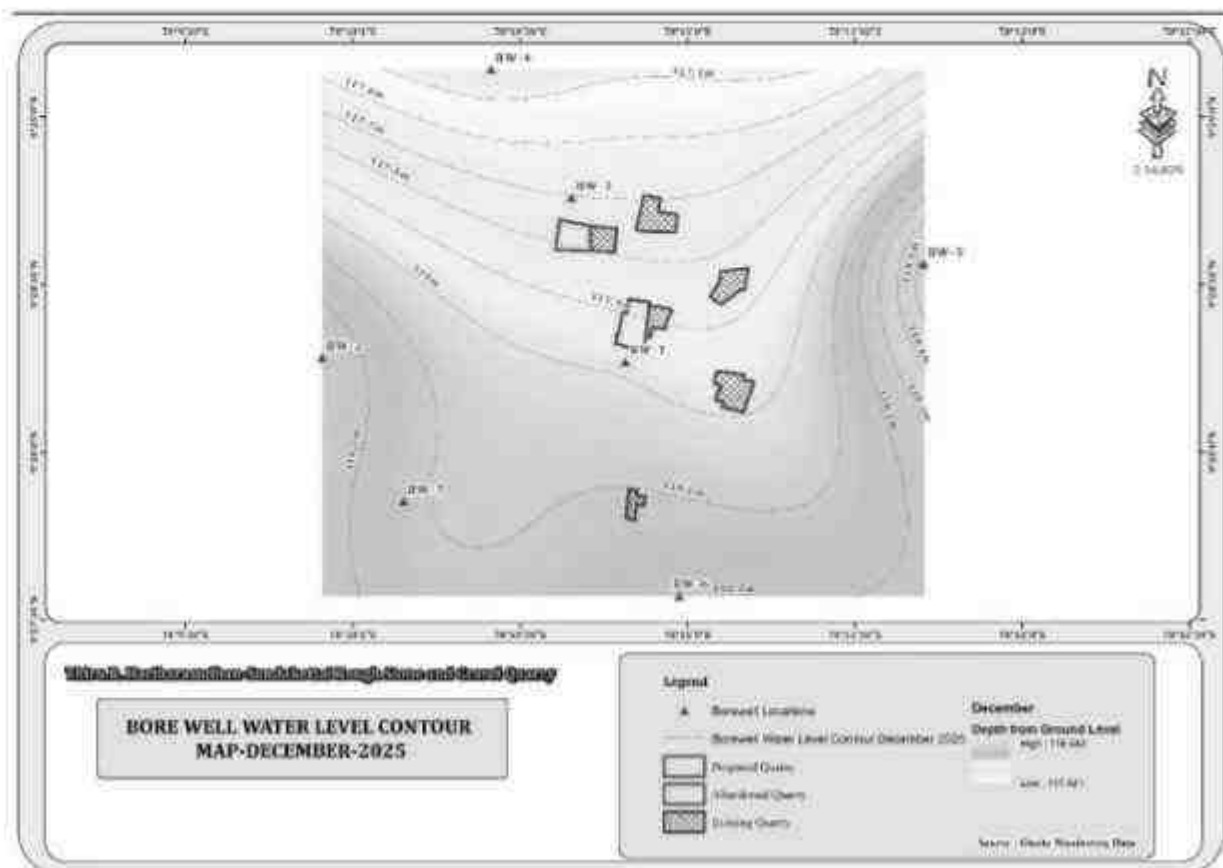
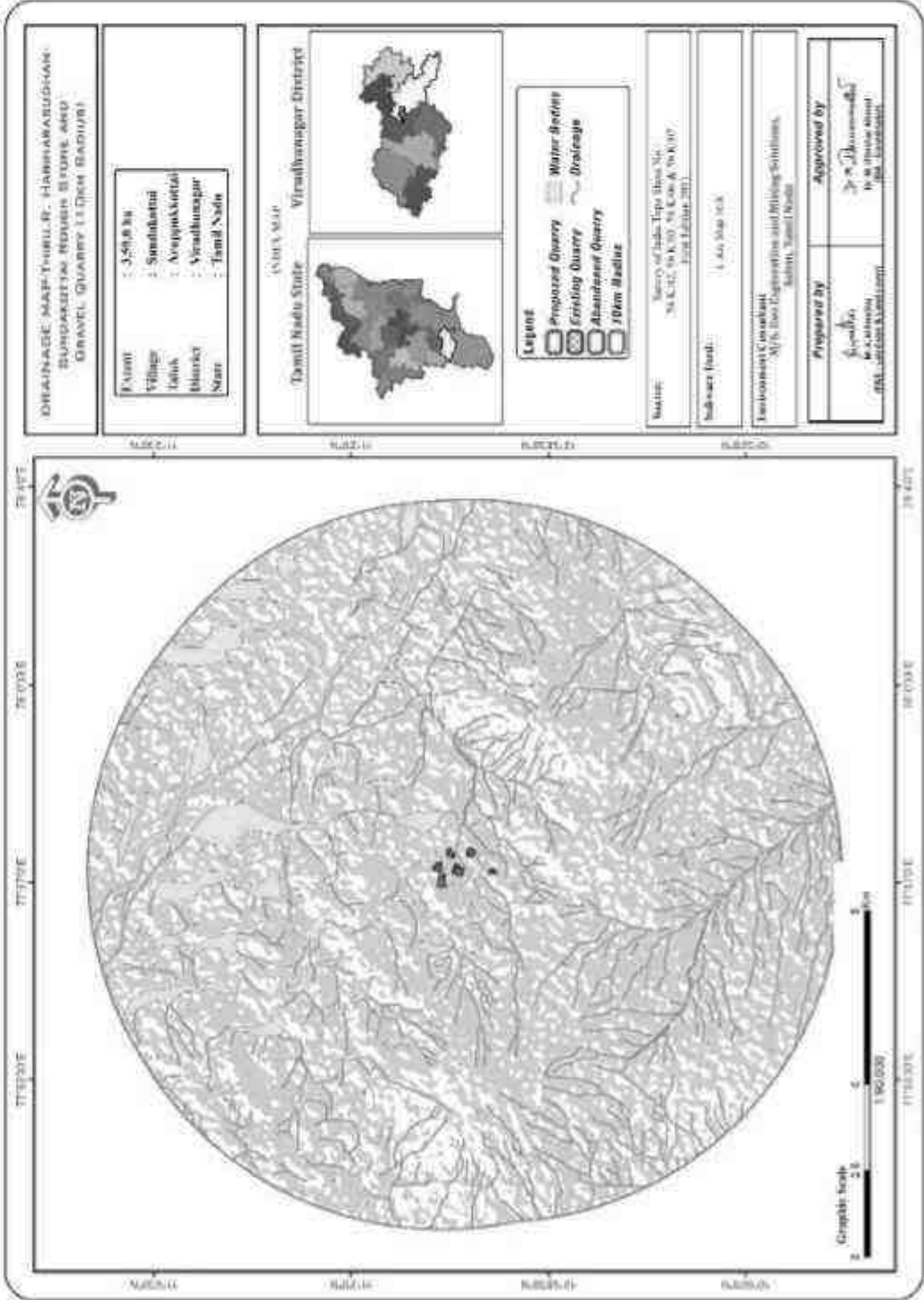


FIGURE 3.9: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE



Geophysical Resistivity Survey

3.2.5.1 Methodology and Data Acquisition

The Geophysical Electrical Resistivity survey conducted in the area Schlumberger configuration, Vertical Electrical Sounding (VES) method. Schlumberger electrode set up was employed for making sounding measurements. Since it is least influenced by lateral in homogeneities and is capable of providing higher depth of investigation. This is four electrodes collinear set up where in the outer electrodes send current into the ground and the inner electrodes measure the potential difference.

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

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

$$\rho_s = \frac{GA\Delta V}{I}$$

ΔV = potential difference between receiving electrodes

G = Geometric Factor.

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

$$\rho_r = F\rho_w = a \phi^m \rho_w$$

ρ_r = Resistivity of Rocks

ρ_w = Resistivity of water in pores of rock

F = Formation Factor

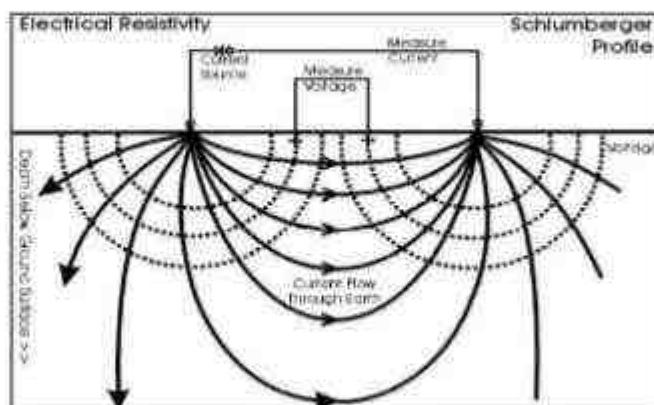
ϕ = Fractional pore volume

A = Constants with values ranging from 0.5 to 2.5

3.2.5.2 Survey Layout

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

RESISTIVITY SURVEY PROFILE



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

3.2.5.3 Data Presentation

It was inferred that the low resistance encountered at the depth between 60-65m. The maximum depth proposed out of proposed projects 42m BGL. Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area.

3.2.5.4 Geophysical Data Interpretation

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

It is inferred that the existing quarries in the surrounding area not intersected the water table is, only the seepage water during rainy season encountered from the upper layer and it will be used for the Greenbelt development, Dust suppression and quarrying operation.

3.3 AIR ENVIRONMENT

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

The baseline studies on air environment include identification of specific air pollution parameters and their existing levels in ambient air. The ambient air quality with respect to the study zone of 10 km radius around the cluster forms the baseline information. The prime objective of the baseline air quality study was to establish the existing

ambient air quality of the study area. These will also be useful for assessing the conformity to standards of the ambient air quality during the operation of proposed projects in cluster.

3.3.1 Meteorology & Climate

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

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

Climate -

- The Virudhunagar lies on 102m above sea level the climate here is considered to be a local steppe climate. The average annual temperature is 28.6 °C | 83.4 °F.
- The precipitation here is around 829 mm | 32.6 inch per year. The driest month is May, with 9 mm | 0.4inch. The greatest amount of precipitation occurs in October, with an average of 144 mm | 5.6 inch.
- The warmest month of the year is October, with an average temperature of 32.2°C | 89.9 °F.
- The lowest average temperatures in the year occur in December, when it is around 22°C | 71.6°F.
- The difference in precipitation between the driest month and the wettest month is 107mm | 7inch. The variation in temperatures throughout the year is 3.4°C | 38.1 °F.

<https://en.climate-data.org/asia/india/tamil-nadu/virudhunagar>

Rainfall

TABLE 3.13: RAINFALL DATA

Actual Rainfall in mm						Normal Rainfall in mm
2019	2020	2021	2022	2023	2024 (As On 30.09.2024)	
13.7	1303.7	968.4	883.1	1166.8	549.1	773

Source: <https://www.twadboard.tn.gov.in/content/virudhunagar>

TABLE 3.14: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Oct-2025	Nov-2025	Dec-2025
1	Temperature (°C)	Max	29.77	28.40	25.93
		Min	25.85	22.64	21.21
		Avg	27.81	25.52	23.57
2	Relative Humidity (%)	Avg	79.09	84.25	86.31

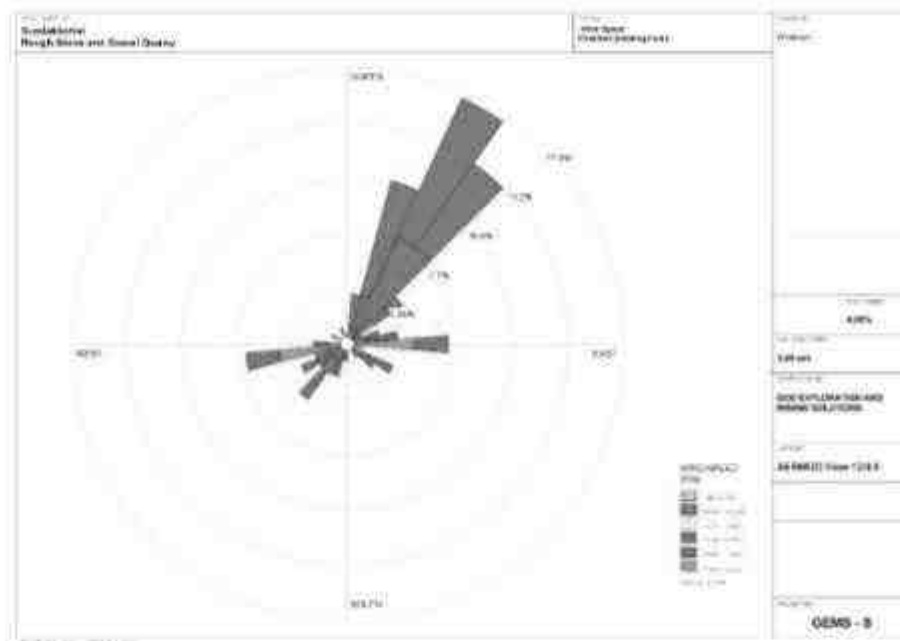
3	Wind Speed (m/s)	Max	4.01	5.48	5.13
		Min	1.30	1.43	1.27
		Avg	2.65	3.45	3.20
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		SW,E	NNE,NE	NNE,NE

Correlation between Secondary and Primary Data

The average rainfall over the period of five years 773mm. The meteorological data collected at the site is almost similar to that of secondary data collected from TWAD Board – Virudhunagar.

Wind rose diagram of the study site is depicted in Figure. 3.11. Predominant downwind direction of the area during study season is West to East & SE

FIGURE 3.11: WINDROSE DIAGRAM



In the abstract of collected data wind rose were drawn on presented in figure No.3.11 during the monitoring period in the study area

1. Predominant winds were from NE, SW, SE
2. Wind speed readings were recorded between 3.60 to 5.70m/s
3. Temperature readings ranging from 23.57 to 27.81°C
4. Relative humidity ranging from 79.09 to 86.31%
5. The monitoring was carried out continuously for three months.

3.3.2 Methodology and Objective

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

- Meteorological condition on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Location of residential areas representing different activities;
- Accessibility and power availability, etc.,

3.3.3 Sampling and Analytical Techniques

TABLE 3.15: METHODOLOGY AND INSTRUMENT USED FOR AAQ ANALYSIS

Parameter	Method	Instrument
PM2.5	Gravimetric Method Beta attenuation Method	Fine Particulate Sampler Make – Thermo Environmental Instruments – TEI 121
PM10	Gravimetric Method Beta attenuation Method	Respirable Dust Sampler Make –Thermo Environmental Instruments – TEI 108
SO ₂	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NO _x	IS-5182 Part II (Jacob & Hochheiser modified method)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by CHENNAI METTEX LAB PRIVATE LIMITED & CPCB Notification

TABLE 3.16: NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl.No.	Pollutant	Time Weighted Average	Concentration in ambient air	
			Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
1	Sulphur Dioxide (µg/m ³)	Annual Avg.*	50.0	20.0
		24 hours**	80.0	80.0
2	Nitrogen Dioxide (µg/m ³)	Annual Avg.	40.0	30.0
		24 hours	80.0	80.0

3	Particulate matter (size less than 10µm) PM10 (µg/m3)	Annual Avg.	60.0	60.0
		24 hours	100.0	100.0
4	Particulate matter (size less than 2.5 µm PM2.5 (µg/m3)	Annual Avg.	40.0	40.0
		24 hours	60.0	60.0

Source: NAAQS CPCB Notification No. B-29016/20/90/PCI-I Dated: 18th Nov 2009

*Annual Arithmetic mean of minimum 104 measurements in a year taken twice a Week 24 hourly at uniform interval.

** 24 hourly / 8 hourly or 1 hourly monitored value as applicable shall be complied with 98 % of the time in a year. However, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

3.3.4 Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at seven (7) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period October 2023- December 2025. The baseline data of ambient air has been generated for PM₁₀, PM_{2.5}, Sulphur Dioxide (SO₂) & Nitrogen Dioxide (NO₂) Monitoring has been carried out as per the CPCB, MoEF guidelines and notifications.

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

3.3.5 Ambient Air Quality Monitoring Stations

Seven (7) monitoring stations were set up in the study area as depicted in Figure 3.12 for assessment of the existing ambient air quality. Details of the sampling locations are as per given below.

TABLE 3.17: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Core Zone	Project Area	9°28'22.76"N 78°10'49.14"E
2	AAQ-2	Near Existing Quarry	400m NE	9°28'32.69"N 78°11'4.85"E
3	AAQ-3	Muthuramalingapuram (Residential)	1.3km SW	9°27'52.02"N 78°10'7.91"E
4	AAQ-4	Kurunaikulam (School)	1.6km NW	9°29'19.65"N 78°10'35.28"E
5	AAQ-5	Aladipatti (Residential)	1.8km NE	9°28'38.48"N 78°11'53.36"E
6	AAQ-6	M Reddyapatti (School)	5.5km SE	9°25'42.61"N 78°12'26.84"E
7	AAQ-7	Savasapuram (Residential)	4.2km West	9°28'52.68"N 78° 8'31.90"E

Source: On-site monitoring/sampling by CHENNAI METTEX LAB PRIVATE LIMITED in association with GEMS.

FIGURE 3.12: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIIUS

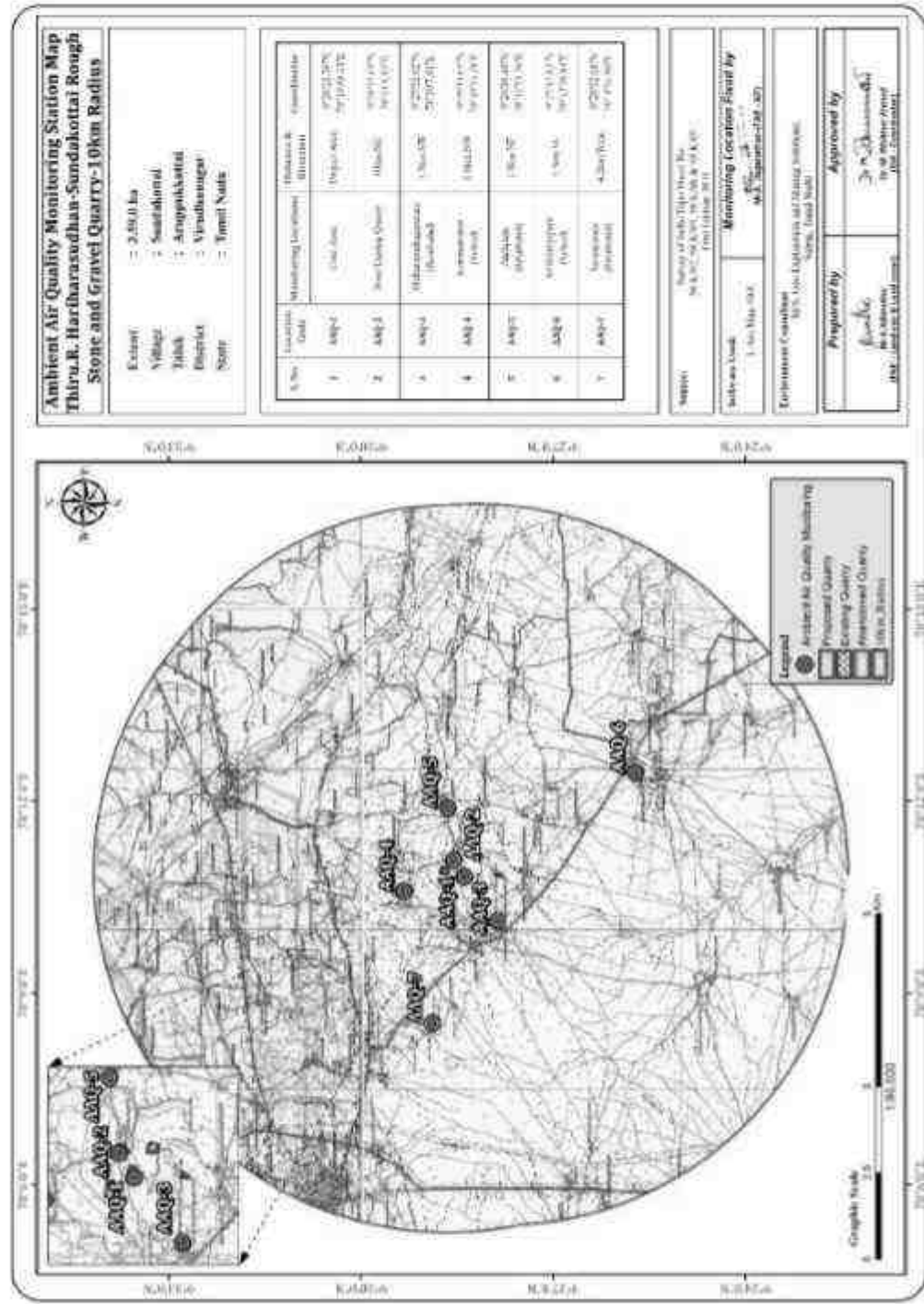


TABLE 3.18: SUMMARY OF AAQ 1 to AAQ 7

PM10	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Arithmetic Mean	39.7	39.4	34.9	21.4	42.3	37.0	38.7
Minimum	37.3	31.2	32.9	20.1	40.0	32.1	37.5
Maximum	41.7	41.7	36.9	22.7	44.9	39.9	40.3
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0
PM2.5	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Arithmetic Mean	24.1	24.1	22.7	42.0	22.7	21.3	21.3
Minimum	23.1	23.1	21.3	40.2	20.0	19.0	19.4
Maximum	25.4	25.4	24.6	43.8	25.9	23.3	23.0
NAAQ Norms	60.0	60.0	60.0	60.0	60.0	60.0	60.0
SO2	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Arithmetic Mean	5.2	5.0	6.0	6.1	6.0	6.0	6.2
Minimum	4.2	4.0	5.1	5.5	4.6	4.2	5.1
Maximum	5.9	5.9	6.8	6.9	7.1	6.9	7.0
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0
NO2	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Arithmetic Mean	19.7	19.7	24.3	19.9	21.2	23.4	23.0
Minimum	18.2	18.2	22.5	18.8	20.1	20.3	21.0
Maximum	20.8	20.8	26.0	21.3	22.5	26.4	25.0
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0

TABLE 3.19: ABSTRACT OF AMBIENT AIR QUALITY DATA

	Parameter	PM10	PM2.5	SO ₂	NO ₂
	No. of Observations	182	182	182	182
1	10 th Percentile Value	21.8	20.5	4.8	19.3
2	20 th Percentile Value	34.5	21.5	5.1	19.6
3	30 th Percentile Value	36.1	22.2	5.4	20.2
4	40 th Percentile Value	37.5	22.5	5.6	20.6
5	50 th Percentile Value	38.3	23.4	5.8	21.1
6	60 th Percentile Value	38.9	23.8	6.0	21.7
7	70 th Percentile Value	39.7	24.3	6.3	22.8
8	80 th Percentile Value	40.8	24.8	6.5	23.6
9	90 th Percentile Value	41.7	41.3	6.7	24.6
10	95 th Percentile Value	42.8	42.6	6.8	25.1
11	98 th Percentile Value	43.4	43.4	6.9	25.9
12	Arithmetic Mean	36.2	25.5	5.8	21.6
13	Geometric Mean	35.4	24.7	5.7	21.5
14	Standard Deviation	6.5	6.9	0.7	2.1
15	Minimum	20.1	19.0	4.0	18.2
16	Maximum	44.9	43.8	7.1	26.4
	NAAQ Norms*	100.0	60.0	80.0	80.0
	% Values exceeding Norms*	0.0	0.0	0.0	0.0

FIGURE 3.13: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ7

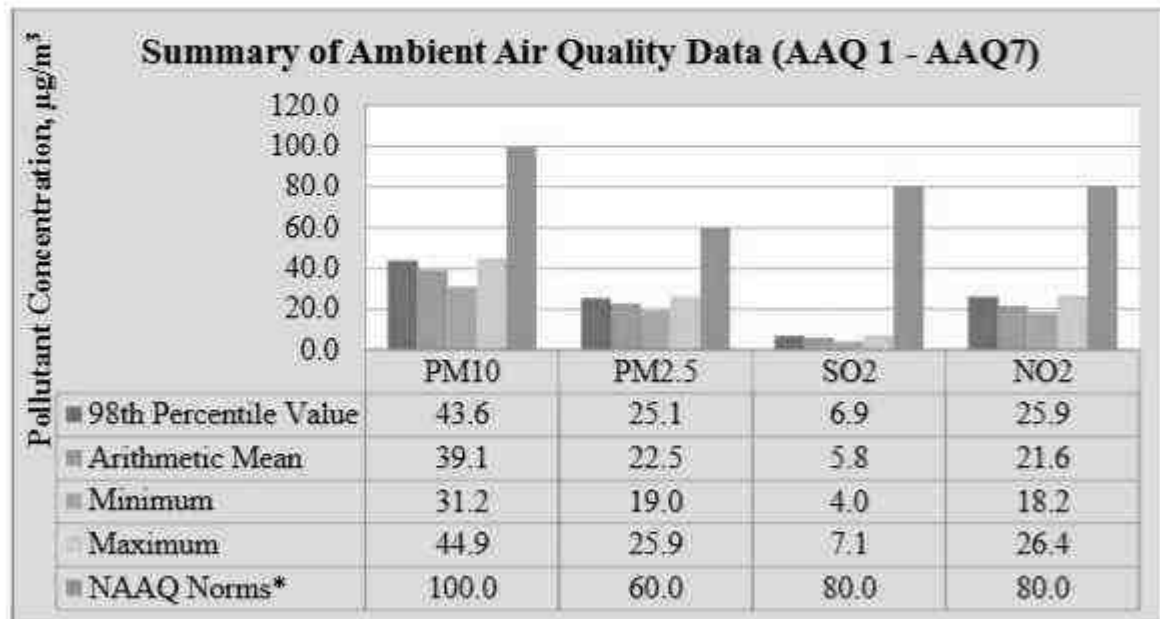
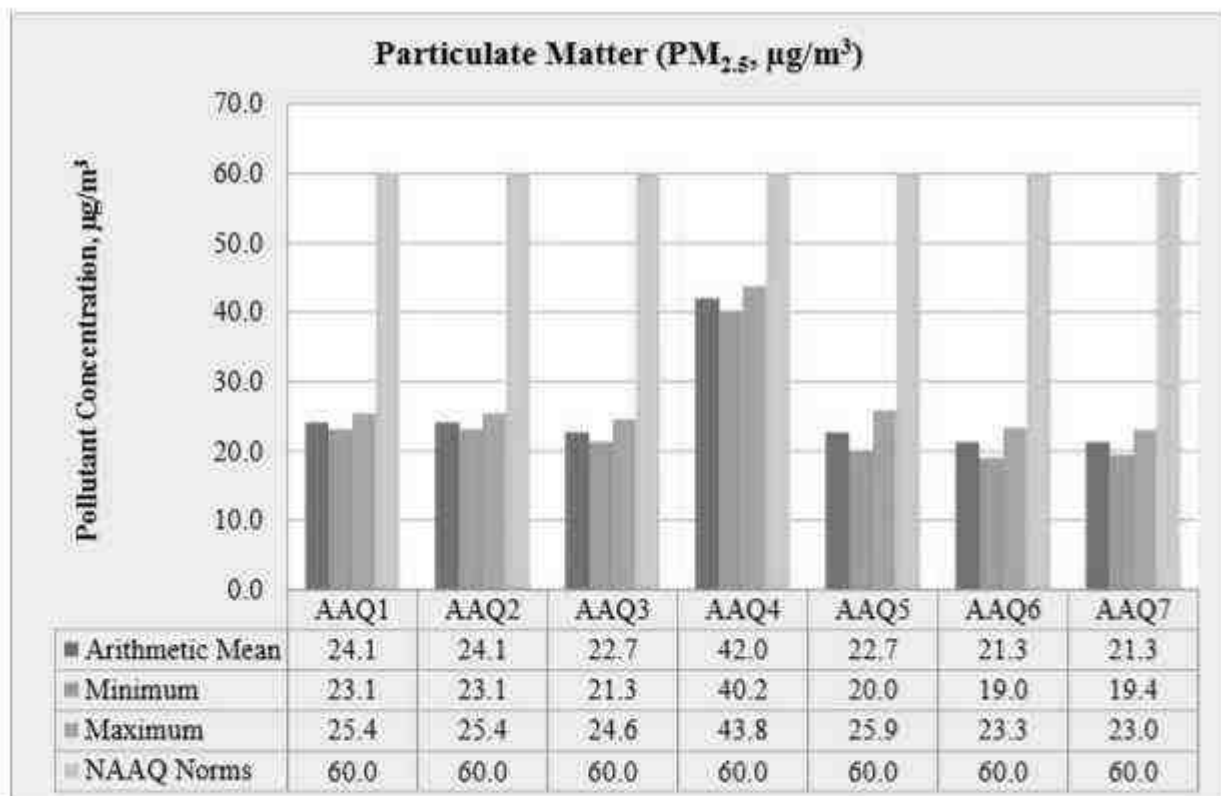
FIGURE 3.14: BAR DIAGRAM OF PARTICULATE MATTER $\text{PM}_{2.5}$ 

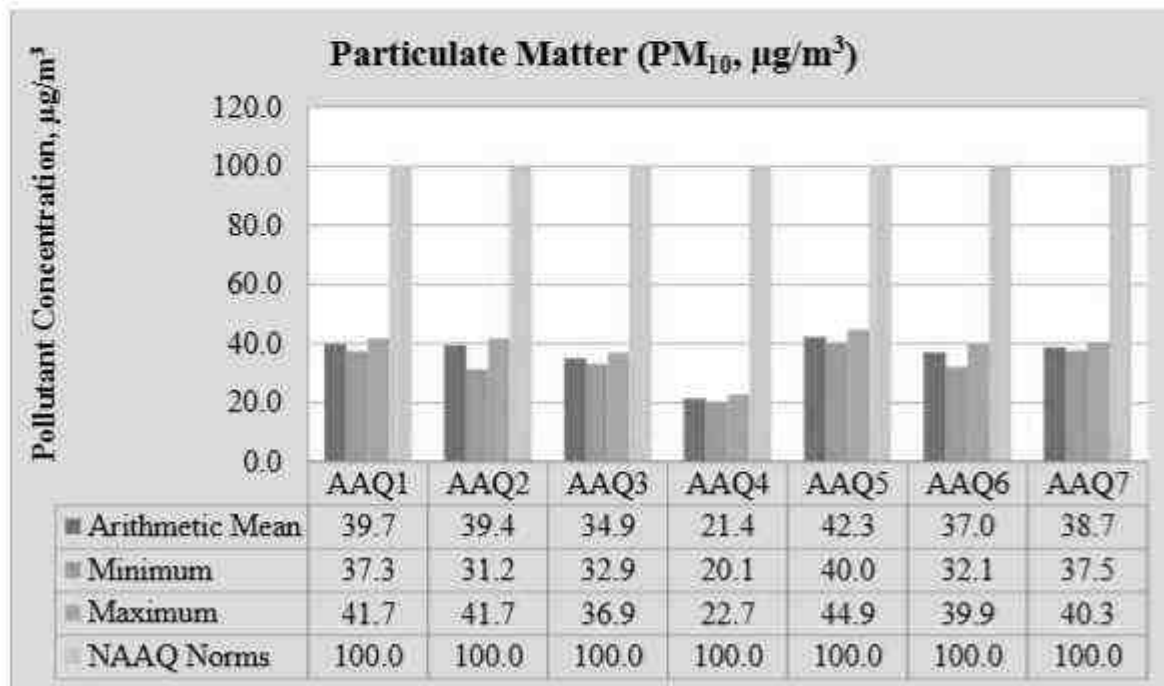
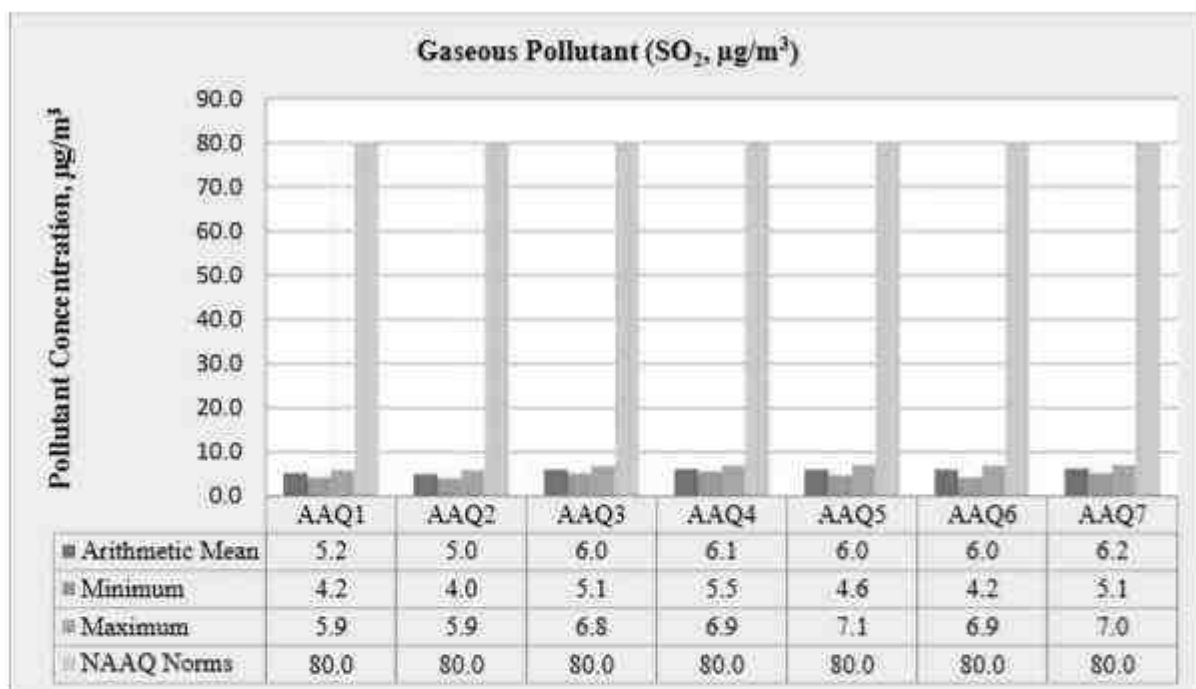
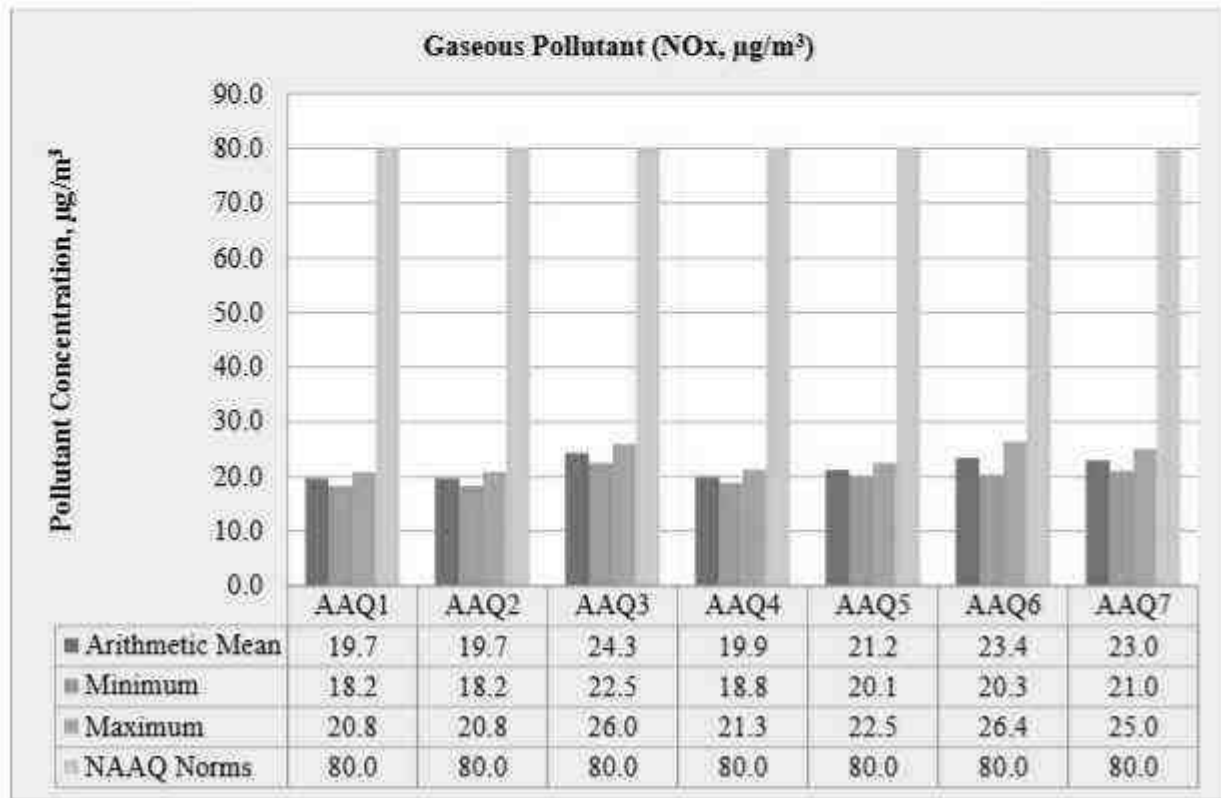
FIGURE 3.15: BAR DIAGRAM OF PARTICULATE MATTER PM₁₀FIGURE 3.16: BAR DIAGRAM OF GASEOUS POLLUTANT SO₂

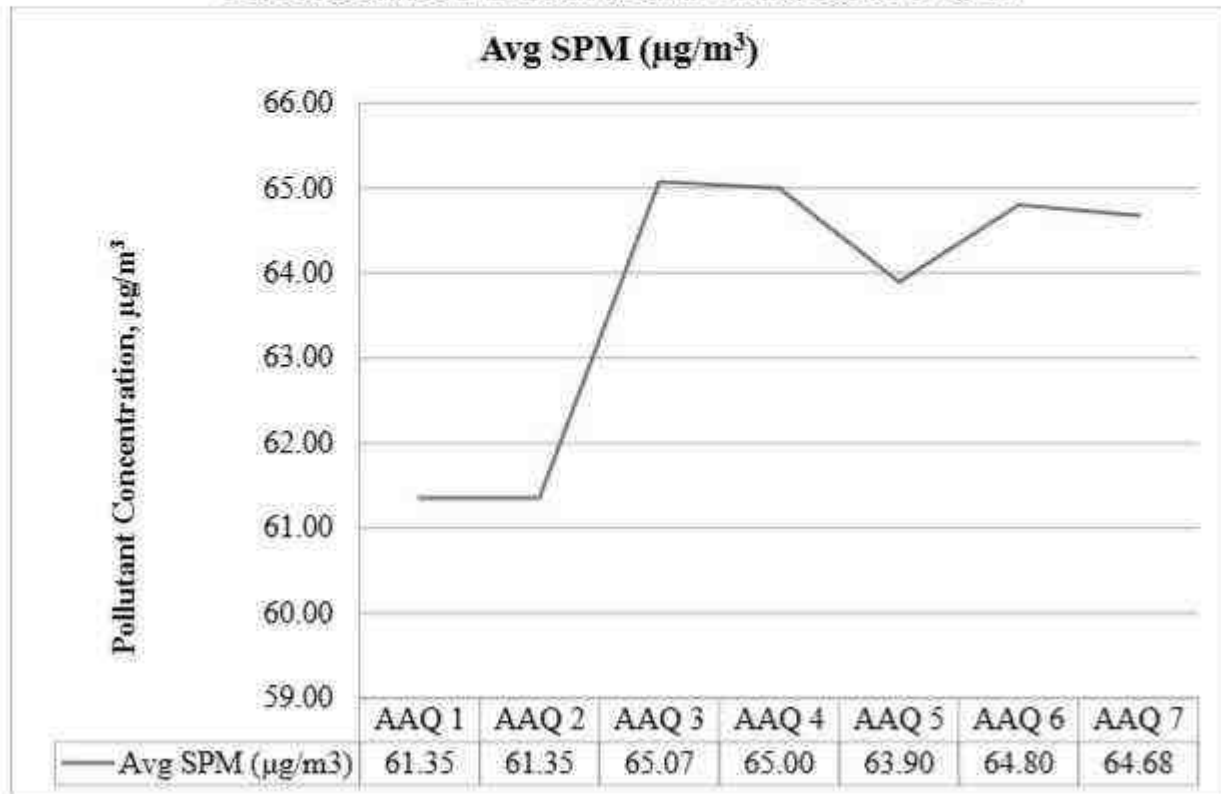
FIGURE 3.17: BAR DIAGRAM OF GASEOUS POLLUTANT NO_x**3.3.7 Fugitive Dust Emission –**

Fugitive dust was recorded at 7AAQ monitoring stations for 30 days average during the study period.

TABLE 3.20: AVERAGE FUGITIVE DUST SAMPLE VALUES

AAQ Locations	Avg SPM (µg/m ³)
AAQ 1	61.35
AAQ 2	61.35
AAQ 3	65.11
AAQ 4	65.00
AAQ 5	63.82
AAQ 6	64.80
AAQ7	64.68

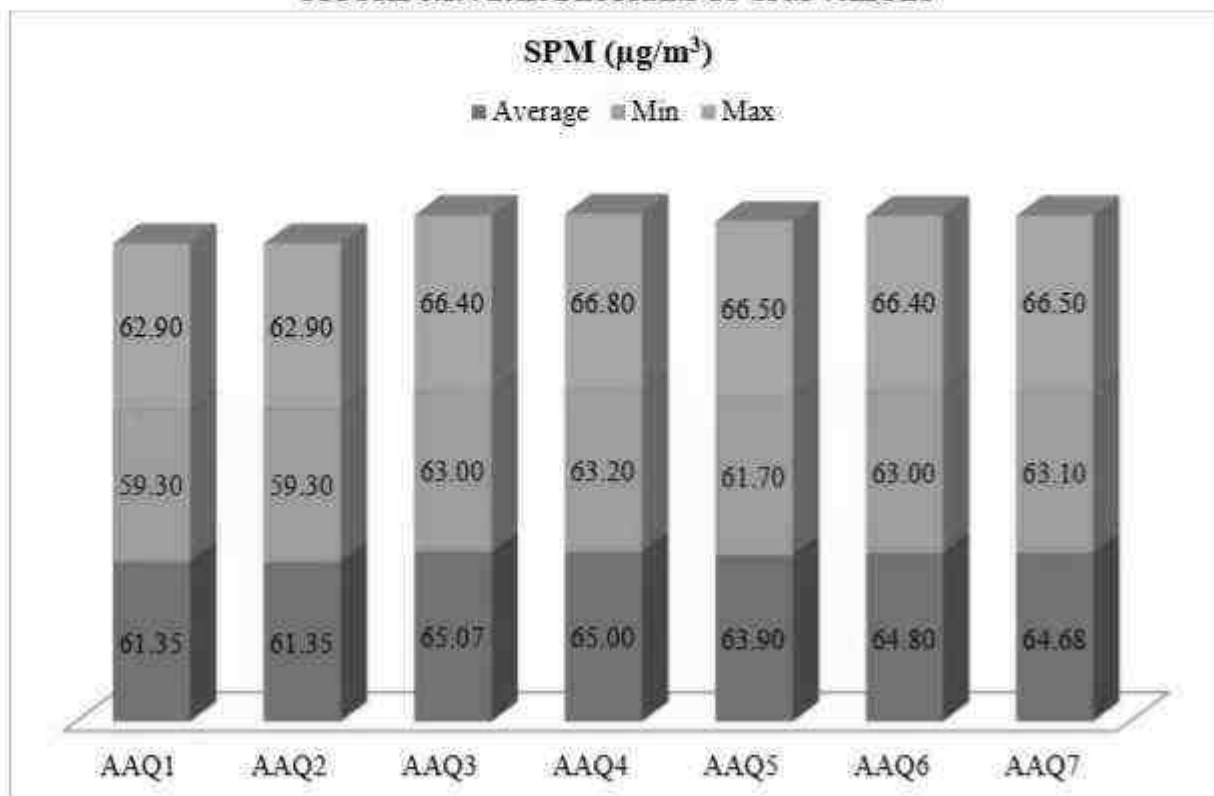
FIGURE 3.18: LINE DIAGRAM OF AVERAGE SPM VALUES

TABLE 3.21: FUGITIVE DUST SAMPLE VALUES IN $\mu\text{g}/\text{m}^3$

SPM ($\mu\text{g}/\text{m}^3$)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Average	61.3	61.3	65.07	65	63.89	64.8	64.67
Min	59.3	59.3	63	63.2	61.7	63	63.1
Max	62.9	62.9	66.4	66.8	66.5	66.4	66.5

Source: Calculations from Lab Analysis Reports

FIGURE 3.19: BAR DIAGRAM OF SPM VALUES



3.3.6 Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from $31.2 - 44.9 \mu\text{g}/\text{m}^3$, $PM_{2.5}$ data ranges from $19.0 - 25.9 \mu\text{g}/\text{m}^3$, SO_2 ranges from $4.0 - 7.1 \mu\text{g}/\text{m}^3$ and NO_2 data ranges from $18.2 - 26.4 \mu\text{g}/\text{m}^3$. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

3.4 NOISE ENVIRONMENT

The vehicular movement on road and mining activities is the major sources of noise in study area, the environmental assessment of noise from the mining activity and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance and general community responses. The main objective of noise monitoring in the study area is to establish the baseline noise level and assess the impact of the total noise expected to be generated during the project operations around the project site.

3.4.1 Identification of Sampling Locations

In order to assess the ambient noise levels within the study area, noise monitoring was carried out at Seven (7) locations. The noise level measurement was carried out at each ambient air quality station. The main aim of the noise level monitoring is

- To assess the ambient Noise level in the study area
- Type of noise pollution generated in the core zone

- To predict the temporal changes in the ambient noise level in the area

The noise level monitoring locations were carried out by covering commercial, residential, rural areas within the radius of 10km. A noise monitoring methodology was chosen such that it best suited the purpose and objectives of the study.

TABLE 3.22: DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Core Zone	Project Area	9°28'23.75"N 78°10'52.53"E
2	N-2	Near Existing Quarry	400m NE	9°28'32.51"N 78°11'4.69"E
3	N-3	Muthuramalingapuram (Residential)	1.3km SW	9°27'53.05"N 78°10'4.82"E
4	N-4	Kurunaikulam (School)	1.6km NW	9°29'19.24"N 78°10'35.06"E
5	N-5	Aladipatti (Residential)	1.8km NE	9°28'38.65"N 78°11'52.91"E
6	N-6	M Reddyapatti (School)	5.5km SE	9°25'42.31"N 78°12'26.12"E
7	N-7	Savaspuram (Residential)	4.2km West	9°28'53.13"N 78° 8'31.96"E

Source: On-site monitoring/sampling by CHENNAI METTEX LAB PRIVATE LIMITED in association with GEMS.

3.4.2 Method of Monitoring

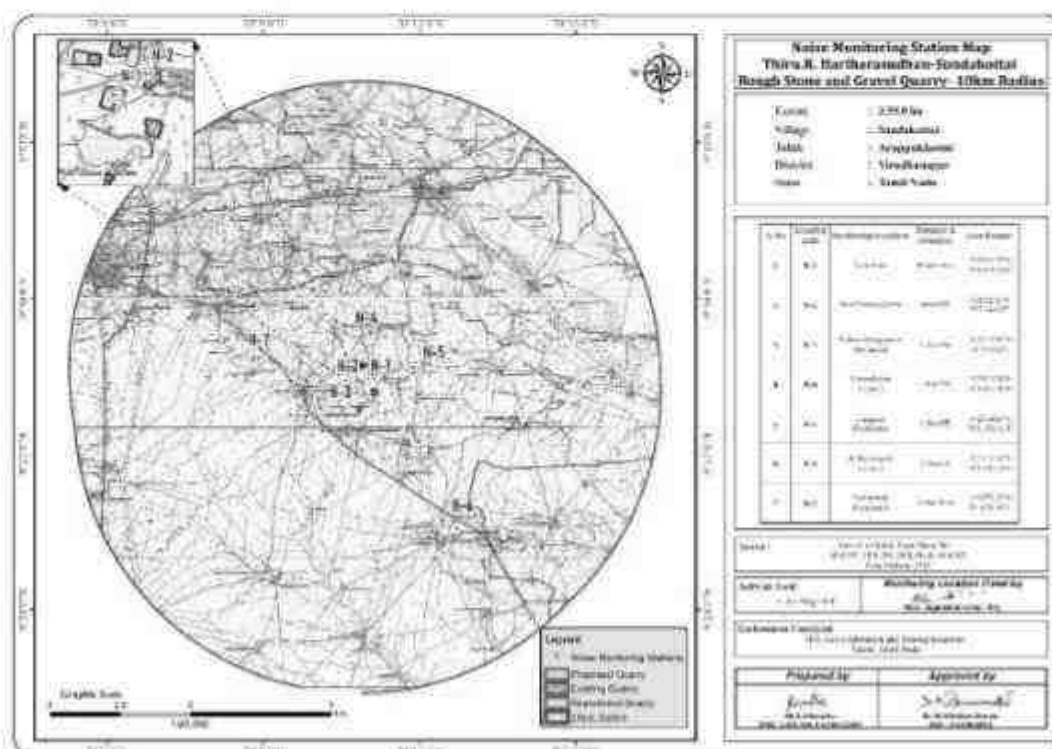
Digital Sound Level Meter was used for the study. All reading was taken on the 'A-Weighting' frequency network, at a height of 1.5 meters from ground level. The sound level meter does not give a steady and consistent reading and it is quite difficult to assess the actual sound level over the entire monitoring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

$$Leq = 10 \log L / T \sum (10L_n/10)$$

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

T = Time interval of observation

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

FIGURE 3.20: NOISE MONITORING STATIONS AROUND 10 KM RADIUS

3.4.3 Analysis of Ambient Noise Level in the Study Area

The Digital Sound pressure level has been measured by a sound level meter (Model: HTC SL-1352)

An analysis of the different Leq data obtained during the study period has been made. Variation was noted during the day-time as well as night-time. The results are presented in below Table 3.23.

Day time: 6:00 hours to 22:00 hours.

Night time: 22:00 hours to 6:00 hours.

TABLE 3.23: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core Zone	39.6	35.3	Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)
2	Near Existing Quarry	39.0	34.5	
3	Muthuramalingapuram (Residential)	41.0	35.8	Residential Day Time- 55 dB (A) Night Time- 45 dB (A)
4	Kurunaikulam (School)	42.0	34.9	
5	Aladipatti (Residential)	40.0	34.6	
6	M Reddyapatti	42.1	37.3	

	(School)			
7	Savaspuram (Residential)	41.0	35.8	

Source: On-site monitoring/sampling by CHENNAI METTEX LAB PRIVATE LIMITED in association with GEMS.

FIGURE 3.21: DAY TIME NOISE LEVELS IN CORE AND BUFFER ZONE

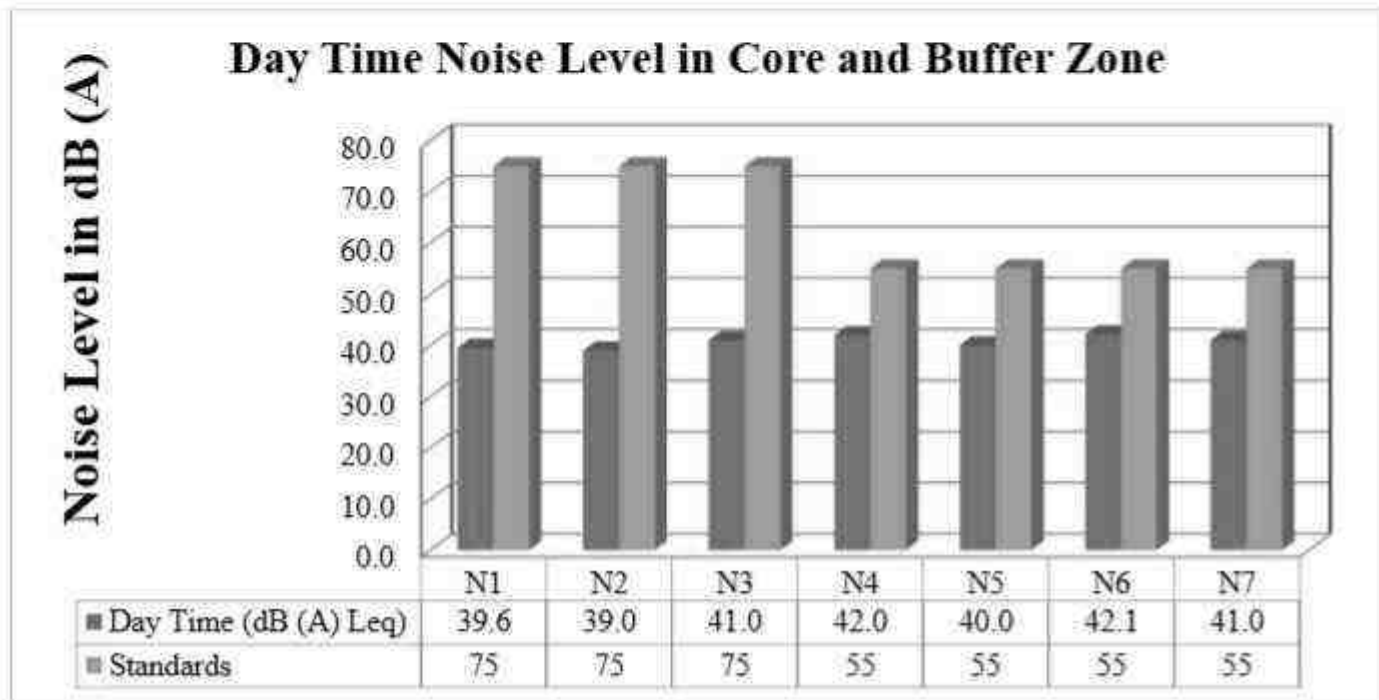
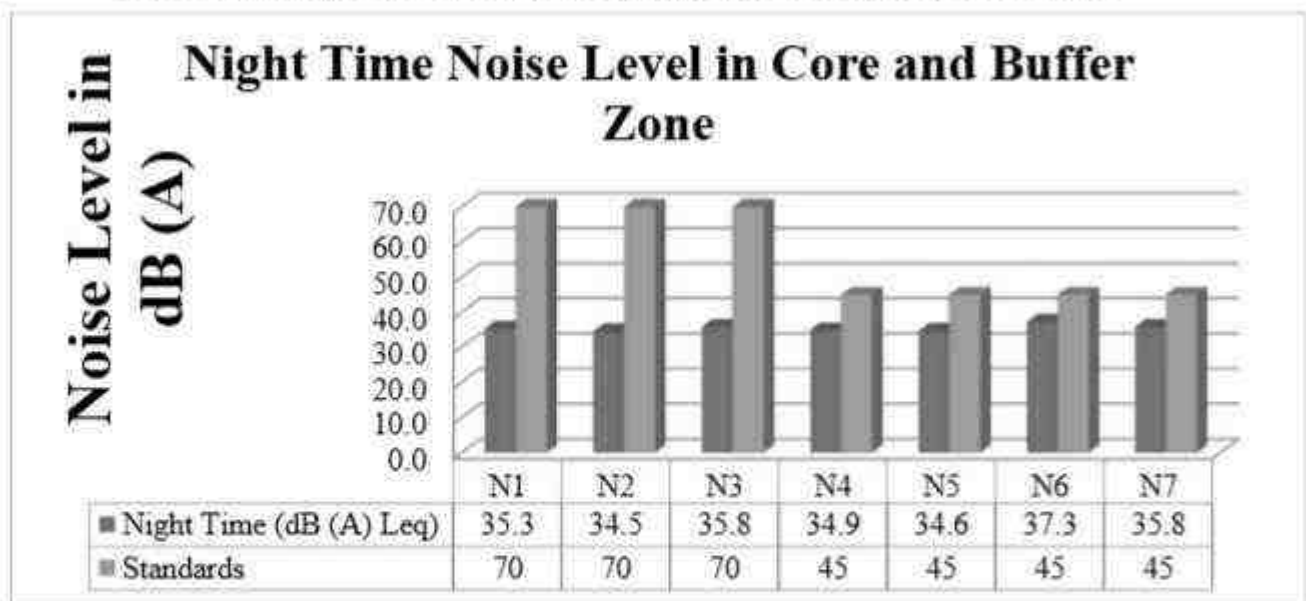


FIGURE 3.22: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE



3.4.4 Interpretation & Conclusion:

Ambient noise levels were measured at 7 (Seven) locations around the proposed project area. Noise levels recorded in core zone during day time were from 39.0 – 39.6 dB (A) Leq and during night time were from 34.5 – 35.3 dB (A) Leq. Noise levels recorded in buffer zone during day time were from 40.0 – 42.1 dB (A) Leq and during night time were from 34.6 – 37.3 dB (A)Leq. Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.5 BIOLOGICAL ENVIRONMENT

3.5.5.1. General Ecological Assessment

The observations and assessment of the overall ecological scenario presented in this chapter include details of flora, fauna, natural habitats, and Wildlife in the study area. Such information provides better understanding of the situation and overall ecological importance of the area. This information viewed against project activities helps in predicting their impacts on the wildlife and their habitats in the region.

3.5.5.2. The vegetation in the RF / PF areas, ecologically sensitive areas

There are neither reserved (RF) nor protected (PF) forests either in the mine lease area or in the buffer zone. Thus, no forest land is involved in any manner. Hence, no certificate from the Forest department is required.

Thus, no forest land is involved in any manner. There are no impacts due to this mining activity. There are neither forests nor forest dwellers nor 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.

3.5.5.3. Ecological Sensitive Areas and Ecosystems in the study area

There are no protected or ecologically sensitive areas such as National parks or Important Bird Areas (IBAs), or Wetlands or migratory routes of fauna or water bodies or human settlements within the proposed mine lease area. There are no Biosphere reserves or wildlife sanctuaries or National parks or Important Bird Areas (IBAs), or migratory routes of fauna. Thus, the area under study (Mine lease area and the 10 Km buffer zone) is not ecologically sensitive. It is away from the proposed project site.

3.5.5.4 Floral diversity

The study is carried out to assess the existing and future scenarios of mining projects, specifically in terrestrial and aquatic areas. After surveying the core and the buffer areas, a detailed floral inventory has been compiled. A list of all plants from the study area was prepared and their habitats were recorded.

3.5.5.5. Terrestrial Vegetation

According to the Primary Field Survey, the flora is highly varied with includes vegetation of the species of Herbs, Shrubs, Climbers, Trees, and Major agricultural crops, were documented during this baseline survey. The dominant plant species growing in this area were *Prosopis juliflora*, *Azadirachta indica*, *Calotropis gigantea*, *Cissus quadrangularis*, *Vachellia leucophloea* etc.

3.5.5.6 Quadrat Sampling Method

The quadrat sampling technique was used for sampling vegetation. Sampling quadrats of the regular shape of dimensions 10 × 10 m, 5 × 5 m, and 1 × 1 m, were nested within each other and were defined as the units for sampling the area and measuring the diversity of trees, shrubs, and herbs respectively.

TABLE 3.24: INVENTORY OF FLORAL DIVERSITY IN THE CORE ZONE

Sl.No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Velvet mesquite	Velikathaan	<i>Prosopis juliflora</i>	Fabaceae
2.	Neem or Indian lilac	Vembu maram	<i>Azadirachta indica</i>	Meliaceae
3.	White Bark Acacia	Vela maram	<i>Vachellia leucophloea</i>	Fabaceae
4.	Madras thorn	Kudukapuli	<i>Pithecellobium dulce</i>	Fabaceae
5.	River tamarind	Savundal maram	<i>Leucaena leucoccephala</i>	Fabaceae
6.	Jamun Fruit Plant	Naval maram	<i>Syzygium cumini</i>	Myrtaceae
7.	Jujube Trees	Elantha Pazham	<i>Ziziphus Mauritana</i>	Rhamnaceae
8.	Milletia Pinnata	Pongam oiltree	<i>Pongamia pinnata</i>	Fabaceae
9.	Wild Date Palm	Icham	<i>Phoenix sylvestris</i>	Arecaceae
10.	Peepal	Asoka maram	<i>Ficus religiosa</i>	Legume

11.	Mango	Manga	<i>Mangifera indica</i>	Anacardiaceae
12.	Indian mulberry	Nuna marani	<i>Morinda tinctoria</i>	Rubiaceae
13.	Malayan Cherry	Ten Pazham	<i>Muntingia calabura</i>	Muntingiaceae
Shrubs				
14.	West Indian Lantana	Unni chedi	<i>Lantana camara</i>	Verbenaceae
15.	Avaram	Avarai	<i>Senna auriculata</i>	Fabaceae
16.	Indian mallow	Thuthi	<i>Abutilon indicum</i>	Meliaceae
17.	Jackal jube	Surai Bantai	<i>Ziziphus oenophia</i>	Rhamnaceae
18.	Devil's trumpet	Umathai	<i>Datura metel</i>	Solanaceae
19.	Tanner's cassia	Avaram	<i>Senna auriculata</i>	Fabaceae
20.	Triangular spruce	Chaturakalli	<i>Euphorbia antiquorum</i>	Euphorbiaceae
21.	Malabar catmint	Pei veratti	<i>Anisomeles malabarica</i>	Lamiaceae
22.	Milk Weed	Erukku	<i>Calotropis gigantea</i>	Apocynaceae
23.	Indian Oleander	Arali	<i>Nerium indicum</i>	Apocynaceae
24.	Black-Honey Shrub	Ink pazham	<i>Phyllanthus reticulatus</i>	Phyllanthaceae
25.	Castor bean	Amanakku	<i>Ricinus communis</i>	Euphorbiaceae
26.	Triangular spruce	Chaturakalli	<i>Euphorbia antiquorum</i>	Euphorbiaceae
27.	Purging nut	Kattamanakku	<i>Jatropha curcas</i>	Euphorbiaceae
Herbs				
28.	Indian nettle	Nayuruci	<i>Achyranthes aspera</i>	Amaranthaceae
29.	Cleome viscosa	Nai kadugu	<i>Cleome viscosa</i>	Capparidaceae
30.	Mountain knotgrass	Sirukan Peelai	<i>Aerva lanata</i>	Amaranthaceae
31.	Common leucas	Thumbai	<i>Leucas aspera</i>	Lamiaceae
32.	Dwarf morning-glory	Vishnukranti	<i>Evolvulus alsinoides</i>	Convolvulaceae
33.	Coat buttons	Thatha poo	<i>Tradax procumbens</i>	Asteraceae
34.	Holy basil	Thulasi	<i>Ocimum tenuiflorum</i>	Lamiaceae
35.	Indian doab	Arugampul	<i>Cynodon dactylon</i>	Poaceae
36.	Fish poison	Kolmchi	<i>Tephrosia purpurea</i>	Fabaceae
Climber				
37.	Stemmed vine	Perandai	<i>Cissus quadrangularis</i>	Vitaceae
38.	Stinking passionflower	Poonai puduku chedi	<i>Passiflora foetida</i>	Passifloraceae
39.	Ivy gourd	Kovai	<i>Coccinia grandis</i>	Cucurbitaceae
40.	Cucumis maderaspatanus	Musumusukkai	<i>Mukia maderaspatana</i>	Cucurbitaceae
41.	Wild bitter	Pavarkai	<i>Momordica charantia</i>	Cucurbitaceae
42.	Rosary Pea	Gundumani	<i>Abrus precatorius</i>	Fabaceae
Grasses				
43.	Narrow leaf cattail	Sambu	<i>Typha angustifolia</i>	Typhaceae
44.	Giant reed	Elephant grass	<i>Arundo donax</i>	Poaceae
45.	Windmill grass	Chevvarakupul	<i>Chloris barbata</i>	Amaranthaceae
46.	Eragrostis	Pullu	<i>Eragrostis ferruginea</i>	Poaceae
Cactus				
47.	Prickly pear	Nagathali	<i>Opuntia dillenii</i>	Cactaceae

3.5.5.7. Invader or exotic species:

Our study showed that *Prosopis juliflora* is one of the most dominant weed terrestrial species and is widespread in the buffer areas of the project site. Our observation during the field visit suggests *Mesosphaerum suaveolens*, *Lantana camara*, and *Ipomoea carnea* & *Mesosphaerum suaveolens* are fast growing in the area.

3.5.5.8. Endangered/Threatened/Protected Species

Our field survey in the project area suggests that there are no Endangered, Endemic, and Rare Plants species present in the study area.

3.5.5.9 Inventory List of floral diversity

After surveying the core and the buffer areas, a detailed floral inventory has been compiled. A list of all plants from the study area was prepared and their habitats were recorded.

The species of Herbs, Shrubs, Climbers, Trees, and Major agricultural crops, were documented during this base line survey. The dominant plant species growing in this area were *Morinda tinctoria*, *Tectona grandis*, *Cassia siamea*, *Ziziphus mauritiana*, etc.

3.5.6. Analysis of Flora (Core Zone)

The species of Herbs, Shrubs, Climbers, and Trees were documented during this baseline survey. The core zone was fully dominated by species like *Prosopis juliflora*, *Azadirachta indica*, *Abutilon indicum* and

Calotropis gigantea. In the core zone total of 13 tree species with 9 families followed by 14 Shrub species with 10 families, 9 Herb Species with 8 families, 6 Climber species with 4 families, 4 grasses with 3 families and 1 Cactus with 1 family. According to the survey, no endemic, endangered and rare species of flora recorded in study area. (Table No-3.35).

3.5.7 Analysis of Flora (Buffer Zone)

Similar habitats may be found in the buffer area as well, although there is a wider variety of plants there than in the core zone area. The buffer zone was fully dominated by species like *Prosopis juliflora*, *Azadirachta indica*, *Jatropha curcas*, *Pongamia pinnata*, *Calotropis gigantea*, and *Morinda tinctoria*, etc. The buffer zone study area contains a total of 179 species that have been recorded from the buffer zone. The floral (179) varieties among them Trees 53, Herbs 57, Shrubs 46, Climbers/ Creepers 11, Grasses 11, and Cactus 1 were identified. The result of the buffer zone of flora studies shows that Fabaceae and Solanaceae, Euphorbiaceae is the main dominating species in the study area mentioned in Table No 3.34. There are no impacts due to this mining activity. There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. Apart from the proposed project area, there is agricultural land. Horticulture and agricultural land are untouched. There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. A list of floral species has been prepared based on primary survey (site observations) and discussion with local people.

TABLE 3.25: NUMBER OF FLORAL LIFE FORMS IN THE STUDY AREA

S. NO	PLANT LIFE FORM	NUMBER OF SPECIES
1	Trees	33
2	Shrubs	46
3	Herbs	57
4	Climber	11
6	Grass	11
7	Cactus	1
Total No. of Species		179

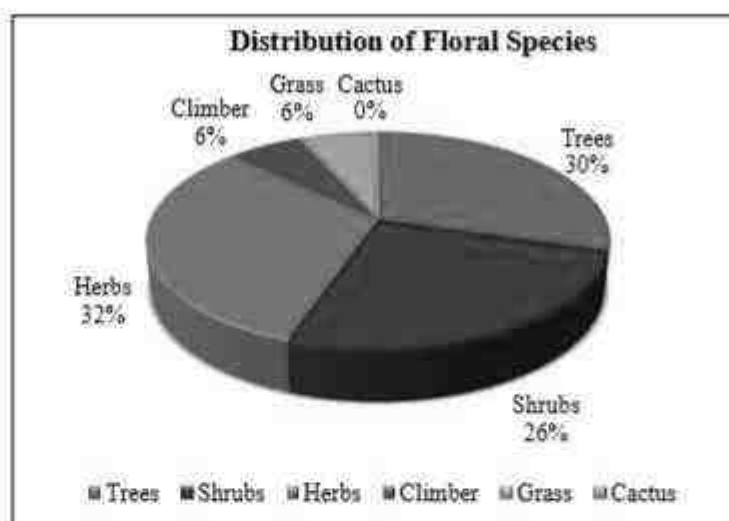


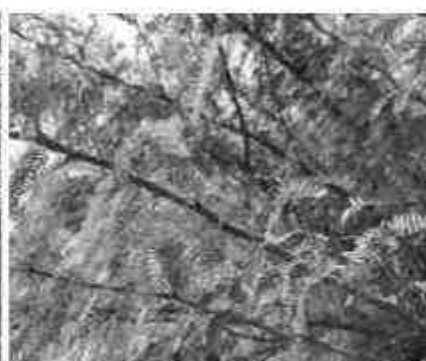
FIGURE 3.23: GRAPH SHOWING % DISTRIBUTION OF FLORAL LIFE FORMS



Azadirachta indica



Thespesia Populnea



Clitoria ternatea



Jatropagossypifolia



Borassus flabellifer



Lantana camara



Heliotropium indicum



Calotropis gigante



Morinda tinctoria



Abrus precatorius



Celome viscosa



Abutilon indicum

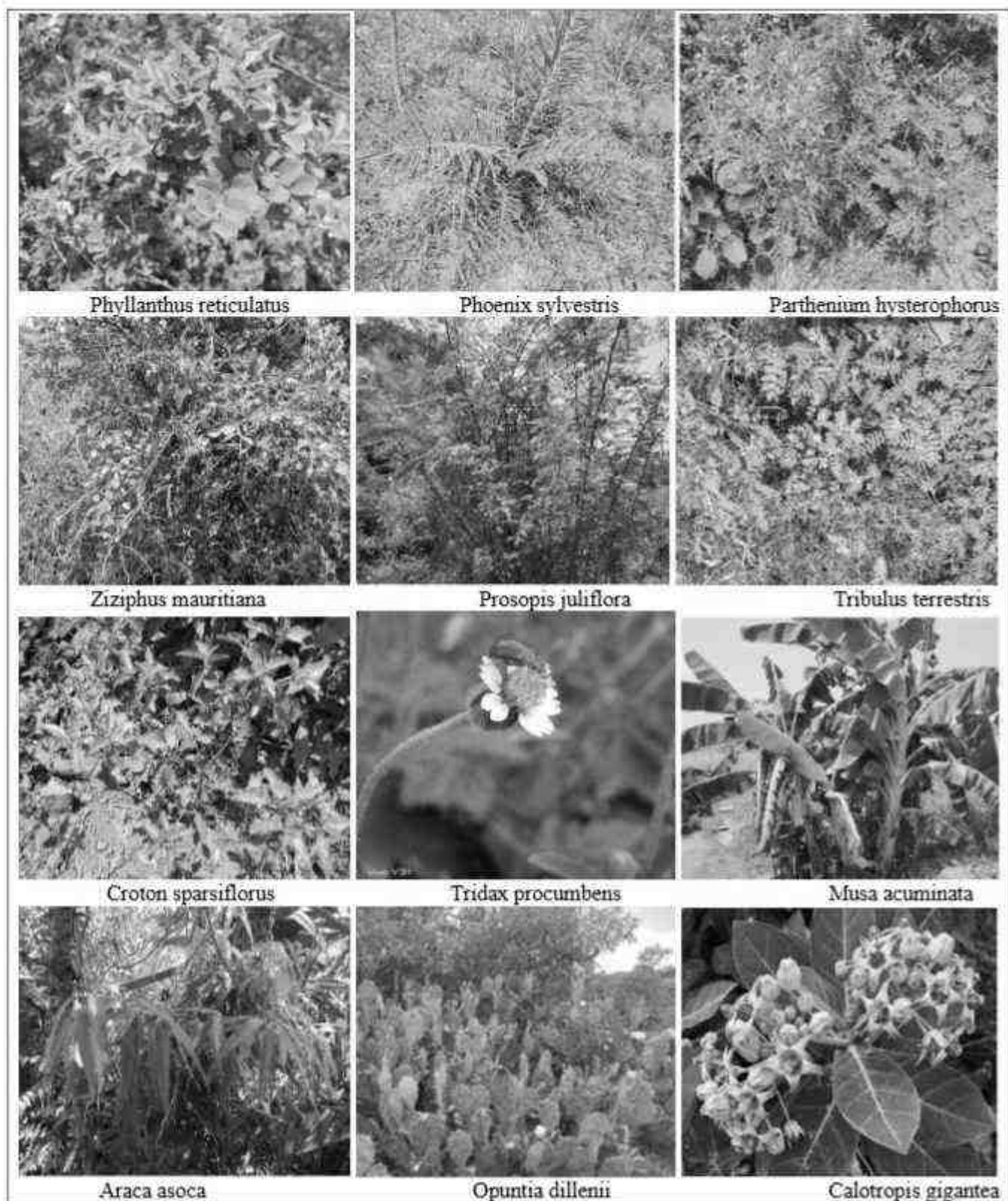


FIGURE 3.24: FLORA SPECIES OBSERVATION IN THE CORE ZONE AREA

TABLE 3.26: INVENTORY OF FLORAL DIVERSITY IN THE BUFFER ZONE

Sl.No	English Name	Veracunar Name	Scientific Name	Family Name
Trees				
1.	Phoenix sylvestris	Peratchai	<i>Phoenix sylvestris</i>	Arecaceae
2.	Velvet mosquito	Velkithaan	<i>Proxipisuliflora</i>	Fabaceae
3.	Cocunut	Thennai maram	<i>Cocos nucifera</i>	Arecaceae
4.	Nee m or Indian lilac	Ve mbu	<i>Asadirachta indica</i>	Melastaceae
5.	Indian mulberry	Nina maram	<i>Morinda tinctoria</i>	Rubiaceae
6.	Indian plum	Elanhai maram	<i>Ziziphus mauritiana</i>	Rhamnaceae
7.	Pongamia pinnata	Pongam	<i>Millettia pinnata</i>	Fabaceae
8.	Oil cake tree	Wunja	<i>Albizia amara</i>	Fabaceae
9.	Eucalyptus	Thulam maram	<i>Eucalyptus leucocornis</i>	Myrtaceae
10.	Asian Palmyra palm	Palai maram	<i>Borassus flabellifer</i>	Arecaceae
11.	River tamarind	Savunda	<i>Leucaena leucophala</i>	Fabaceae
12.	Indian rosewood	Shisham	<i>Dalbergia sissoo</i>	Fabaceae
13.	Sacred Tree	Plane of forest	<i>Bauhinia monosperma</i>	Fabaceae
14.	Madras thorn	Kadukapuli	<i>Pithecollobium dulce</i>	Fabaceae
15.	Portia tree	Povarasai	<i>Thaussia Populnea</i>	Malvaceae
16.	Royal poinciana	Cemmayir Konna	<i>Dalman regia</i>	Fabaceae
17.	Lemon	Ezhumuchalpalam	<i>Citrus lemon</i>	Rutaceae
18.	Janum Fruit Plant	Naval maram	<i>Syzygium cumini</i>	Myrtaceae
19.	Gum arabic tree	Karvelam	<i>Acacia nilotica</i>	Fabaceae
20.	Kassod Tree	Manjal Konrai	<i>Cassia siamea</i>	Fabaceae
21.	Butterfly Tree	Manlam	<i>Bauhinia purpurata</i>	Fabaceae
22.	Common guava	Koyva	<i>Psidium guajava</i>	Myrtaceae
23.	Ava olive tree	Kuthaipadukkan	<i>Sterculia foetida</i>	Malvaceae
24.	Monkey pod tree	Kondramaram	<i>Samanea saman</i>	Fabaceae
25.	Semia siamea	Manjal Konnai	<i>Semiasiamia</i>	Fabaceae
26.	Indian cork tree	Maranali	<i>Millettia hortensis</i>	Leguminosae
27.	Frywood	Vaagai	<i>Albizia lebbek</i>	Mimosaceae
28.	Bambo	Moogil	<i>Bambusa nuda</i>	Poaceae
29.	Indian-almond	Vadamaram	<i>Terminalia catappa</i>	Fabaceae
30.	Teak	Thakku	<i>Tectona grandis</i>	Verbenaceae
31.	The umbrella thorn	Kodave lam	<i>Acacia planifrons</i>	Mimosaceae
32.	Singapore Cherry	Ten pazham	<i>Muntingia calabura</i>	Malvaceae
33.	Curry tree	Karuvappalai	<i>Murraya koenigii</i>	Rutaceae
34.	Sudu	Kalli	<i>Euphorbia ambiquorum</i>	Euphorbiaceae
35.	Oldenite Gooseberry	Nellai	<i>Phyllanthus acidus</i>	Phyllanthaceae
36.	Yellow Flame	Lyaleagu	<i>Peltophorum pterocarpum</i>	Fabaceae
37.	Common fig	Athi Marum	<i>Ficus Carica</i>	Anacardiaceae
38.	Mango	Manga	<i>Mangifera indica</i>	Anacardiaceae

39.	Banyan	Alamaram	<i>Ficus benghalensis</i>	Moraceae
40.	Moringa	Muningai Munim	<i>Moringa oleifera</i>	Moringaceae
41.	Horse tail She-oak	Savukku maram	<i>Casuarina equisetifolia</i>	Casuarinaceae
42.	Creamy peacock flower	Perungondrai	<i>Delonix elata</i>	Fabaceae
43.	Sapodilla	Sappotta	<i>Millettia pinnatifida</i>	Sapotaceae
44.	Indian bael	Vilvam	<i>Aegle marmelos</i>	Rutaceae
45.	Indian gooseberry	Nelli	<i>Phyllanthus emblica</i>	Phyllanthaceae
46.	Guava	Kooya	<i>Psidium guajava</i>	Myrtaceae
47.	Kapok tree	Ilavannaram	<i>Ceibapentandra</i>	Malvaceae
48.	Sugar apple	Silapalam	<i>Annona squamosa</i>	Annonaceae
49.	White-bark acacia	Velvelam	<i>Acacia leucophloea</i>	Mimosaceae
50.	Papaya	Pappuli maram	<i>Carica papaya</i>	Caricaceae
51.	Banana tree	Vazhaimaram	<i>Musa acuminata</i>	Musaceae
52.	Jack fruit	Palamarum	<i>Artocarpus heterophyllus</i>	Moraceae
53.	Tamarind	Puliyamarum	<i>Tamarindus indica</i>	Leguminosae
Shrubs				
1.	Avaram	Avaram	<i>Senna auriculata</i>	Fabaceae
2.	Common Wireweed	Arivalmarai poonda	<i>Sida acuta</i>	Malvaceae
3.	Bush Morning Glory	Neveli Kathamam	<i>Ipomoea carnea</i>	Convolvulaceae
4.	Round leaf Barr-Bush	Adiyoti	<i>Pisonia indica rotundifolia</i>	Malvaceae
5.	Chinese chaste tree	Nochi	<i>Vitex negundo</i>	Lamiaceae
6.	Be Bynche bush	Kanmamaku	<i>Jatropha gossypifolia</i>	Euphorbiaceae
7.	Malabar mil	Adhatoda	<i>Justicia adhatoda</i>	Acanthaceae
8.	Fish poison	Kolmel	<i>Tournefortia purpurea</i>	Fabaceae
9.	Jackal jujube	Sunilanthi	<i>Zizyphus oenoplia</i>	Rhamnaceae
10.	Milk Weed	Erukku	<i>Calotropis gigantea</i>	Apocynaceae
11.	Peacock Flower	Mayil Konthi	<i>Cassipourea pulcherrima</i>	Fabaceae
12.	Solanum pubescent	Malasundai	<i>Solanum pubescens Willd</i>	Solanaceae
13.	Coffee Senna	Nattam Takarai	<i>Cassia occidentalis</i>	Fabaceae
14.	Henna Tree	Maruthan	<i>Lawsonea inermis</i>	Lythraceae
15.	Sicklepod	Oosilhagarai	<i>Cassia tora</i>	Fabaceae
16.	Night shade plant	Sundalka	<i>Solanum torvum</i>	Solanaceae
17.	Messquite	Sennai Karuvellam	<i>Prosopis juliflora</i>	Fabaceae
18.	Triangular spruce	Chaturakalli	<i>Euphorbia antiqorum</i>	Euphorbiaceae
19.	Yellow elder	Manjari Somayathi	<i>Tecoma stans</i>	Bignoniaceae
20.	Pinwheel flower	Nandiar vattai	<i>Tabernaemontana coronata</i>	Apocynaceae
21.	Rough cocklebur	Ottu bechi	<i>Xanthium indicum</i>	Asteraceae
22.	Martynia annua	Thail Kodukukutai	<i>Martynia annua</i>	Martyniaceae
23.	Great bougainvillea	Kaakithapoo	<i>Bougainvillea spectabilis</i>	Nyctaginaceae
24.	Scarlet jungle flame	Sinduram	<i>Ipomoea coccinea</i>	Rubiaceae
25.	Devil's trumpet	Unalhai	<i>Datura metel</i>	Solanaceae

26.	Judiberi	Narielundi	<i>Ziziphus nannularia</i>	Rhamnaceae
27.	Castor bean	Amanakku	<i>Ricinus communis</i>	Euphorbiaceae
28.	Tabasco pepper	Milaga	<i>Capsicum frutescens</i>	Solanaceae
29.	Shoe flower	Chemparruthi	<i>Hibiscus rosa-sinensis</i>	Malvaceae
30.	Nalta jute	Perattikkirai	<i>Corchorus olitorius</i>	Tiliaceae
31.	Firecracker Flower	Kanak Ambaram	<i>Crossandra infundibuliformis</i>	Acanthaceae
32.	Plumeria alba	Malarali	<i>Plumeria alba</i>	Apocynaceae
33.	Blue snake weed	Seenai nayaroovali	<i>Stachytarpheta indica</i>	Verbenaceae
34.	Touch-me-not	Thothalchunungi	<i>Mimosa pudica</i>	Mimosaceae
35.	Rough cocklebur	Marul-umattai	<i>Xanthium strumarium</i>	Asteraceae
36.	Indian mulow	Thuthu	<i>Abutilon indicum</i>	Melastomaceae
37.	Tomato	Thak kali	<i>Lycopersicon esculentum</i>	Solanaceae
38.	Apple of sodom	Velurukku	<i>Calotropis procera</i>	Asclepiadaceae
39.	Indian shot	Kalvalai	<i>Canna indica</i>	Cannaceae
40.	Pig nut	Wild thulasi	<i>Hyptis suaveolens</i>	Lamiaceae
41.	Wild jube	Nari-y-ilantai	<i>Ziziphus nannularia</i>	Rhamnaceae
42.	Wild cape bush	Kattuk kallar	<i>Capparis septaria</i>	Capparidaceae
43.	Indian Oleander	Asali	<i>Nerium indicum</i>	Apocynaceae
44.	Pencil cactus	Thirukalli	<i>Euphorbia tirucalli</i>	Euphorbiaceae
45.	West Indian Lantana	Unni chedi	<i>Lantana camara</i>	Verbenaceae
46.	Kapok Bush	Seiyanaeruvai	<i>Aurva javanica</i>	Amaranthaceae
Herbs				
1.	Tickweed	Nai kadugu	<i>Cleome viscosa</i>	Capparidaceae
2.	Indian Mureury	Kuppanani	<i>Acalypha indica</i>	Euphorbiaceae
3.	Purple pitcher plant	Kavali	<i>Tropaeopsis purpurea</i>	Fabaceae
4.	Seplacweed	Kattuk kalli	<i>Senna occidentalis</i>	Fabaceae
5.	Red Pea Eggplant	Vellai Indiralai	<i>Solanum trilobatum</i>	Solanaceae
6.	Bladder Cherry	Kupanti	<i>Physalis minima</i>	Solanaceae
7.	Shaggy Button Weed	Nattai-chun	<i>Borreria hispida</i>	Rubiaceae
8.	Chamber bitter	Malai Kizhaneili	<i>Phyllanthus torinaria L.</i>	Euphorbiaceae
9.	Carrot grass	Vishapoondru	<i>Parthenium hysterophorus</i>	Asteraceae
10.	Porcupine flower	Kundali	<i>Borreria prionitis</i>	Acanthaceae
11.	Egyptian senna	Mayurkondrai	<i>Cassia tora</i>	Caesalpiniaceae
12.	Billygoat weed	Pumpulu	<i>Ageratum conyzoides</i>	Asteraceae
13.	Green amaranth	Kupraikennai	<i>Amaranthus viridis</i>	Amaranthaceae
14.	Aloe barbadensis	Kattuk kalli	<i>Aloe vera</i>	Asphodelaceae
15.	Billygoat weed	Nattukotti	<i>Ageratum conyzoides</i>	Asteraceae
16.	False daisy	Karsalanakanni	<i>Eclipta prostrata</i>	Asteraceae
17.	Arrowleaf sida	Jelly Leaf	<i>Sida rhombifolia</i>	Malvaceae
18.	Monarch redstem	Kal-i-uruvai	<i>Ammania baccifera</i>	Lythraceae
19.	Indian daisy	Arugampul	<i>Cynodon dactylon</i>	Poaceae

20.	Rough cocklebur	Mānūl-umattai	<i>Xanthium strumarium</i>	Asteraceae
21.	Bell Weed	Potta kanchi	<i>Diploeris prostratus</i>	Acanthaceae
22.	Monarch redstem	Kalluvai	<i>Ammannia baccifera</i>	Lythraceae
23.	Rice weeds	Sorupodai	<i>Colomia procumbens</i>	Borraginaceae
24.	Goat weed	Kallurukki	<i>Scoparia dulcis</i>	Plantaginaceae
25.	Cracker plant	Kiranti nayan	<i>Ruellia tuberosa</i>	Acanthaceae
26.	East Indian globe thistle	Kottai-k-karantai	<i>Sphaeranthus indicus</i>	Asteraceae
27.	Bengal dayflower	Kanavachai	<i>Commelina benghalensis</i>	Commelinaceae
28.	Mexican poppy	Kadiyatti	<i>Argemone mexicana</i>	Papaveraceae
29.	Mountain knotgrass	Sirupalai	<i>Aerva lanata</i>	Amaranthaceae
30.	Indian Tunesole	Thei kodukku	<i>Heliotropium indicum</i>	Borraginaceae
31.	Frog fruit	Poduthalai	<i>Phyla nodiflora</i>	Podthalai
32.	Common leucas	Thumbai	<i>Leucas aspera</i>	Lamiaceae
33.	Fish poison	Kollukai Vela	<i>Tophosia purpurea</i>	Fabaceae
34.	Painted euphorbia	Pal perukki	<i>Euphorbia heterophylla</i>	Euphorbiaceae
35.	Pig weed	Mukkattai Kesarai	<i>Boerhaavia diffusa</i>	Nyctaginaceae
36.	Asthma-plant	Annan pacharisi	<i>Euphorbia hirta</i>	Euphorbiaceae
37.	Rushfoil	Reil poonda	<i>Crotos sparsiflorus</i>	Euphorbiaceae
38.	Poor land lashed	Kunakora	<i>Cyperus compressus</i>	Cyperaceae
39.	Marsh Barbel	Neermuli	<i>Hygrophila auriculata</i>	Acanthaceae
40.	Biringarai	Karsalanakanni	<i>Eclipta alba</i>	Asteraceae
41.	Slender dwarf morning-glory	Vishnukranti	<i>Evolvulus alsinoides</i>	Convolvulaceae
42.	Spiny amaranth	Mullukirai	<i>Amaranthus spinosus</i>	Amaranthaceae
43.	Lady's Fingers	Venduka	<i>Abelmoschus esculentus</i>	Malvaceae
44.	Holy basil	Thulasi	<i>Ocimum sanctum</i>	Lamiaceae
45.	Woolly-Winged Milkwort	Paruppu chedi	<i>Polygala eriophora</i>	Polygalaceae
46.	Tridax daisy	Thaila poo	<i>Tridax procumbens</i>	Asteraceae
47.	Indian Tunesole	Tetkolukki	<i>Indian heliotrope</i>	Borraginaceae
48.	Gloome gynandra	Kattu Kadagu	<i>Cleome gynandra</i>	Cleomaceae
49.	Globe Amaranth	Vandamali	<i>Gomphrena globosa</i>	Amaranthaceae
50.	Dwarf morning-glory	Vishnukranti	<i>Evolvulus alsinoides</i>	Convolvulaceae
51.	Indian nettle	Nayuvai	<i>Achyranthes aspera</i>	Amaranthaceae
52.	Negro Coffee	Payavani	<i>Cassia occidentalis</i>	Caesalpiniaceae
53.	Gale of the wind	Kedaneeli	<i>Phyllanthus niruri</i>	Phyllanthaceae
54.	Red Morning Glory	Karavalikodi	<i>Ipomoea hederifolia</i>	Convolvulaceae
55.	Obscure Morning Glory	Chiruthi	<i>Ipomoea obscura</i>	Convolvulaceae
56.	Tricolobe False Mallow	Pimuk Kesarai	<i>Malvastrum coromandelianum</i>	Malvaceae
57.	Indian Whitehead	Vella ragu	<i>Emicostema axillare</i>	Gentianaceae
Climber				
1.	Madras Pea Pumpkin	Musumukai	<i>Musa medeasapina</i>	Cucurbitaceae
2.	Rosary pea	Kundamani	<i>Abrus precatorius</i>	Fabaceae

3.	Bitter apple	Peikunatti	<i>Citrullus colocynthis</i>	Cucurbitaceae
4.	Wild water lemon	Poonai paduku chedi	<i>Passiflora foetida</i>	Passifloraceae
5.	Stemmed vine	Perundai	<i>Cissus quadrangularis</i>	Vitaceae
6.	Bottle gourd	Churikka	<i>Lagearia sicaria</i>	Cucurbitaceae
7.	Butterfly pea	Sangu poo	<i>Chloria ternata</i>	Fabaceae
8.	Bitter melon	Pugarkalai	<i>Momordica charantia</i>	Cucurbitaceae
9.	Balloon vine	Madukathai	<i>Cardiospermum halicacabum</i>	Sapindaceae
10.	Shrinking passionflower	Poonai paduku chedi	<i>Passiflora foetida</i> L.	Passifloraceae
11.	Ivy gourd	Kovai	<i>Coccoloba grandis</i>	Cucurbitaceae
Grass				
1.	Great brome	Thodapram	<i>Bromus diandrus</i>	Poaceae
2.	Umbrella-sedge	Valkonai	<i>Cyperus difformis</i>	Cyperaceae
3.	Finger grass	Kuruthupillu	<i>Chloris dohertyana</i>	Poaceae
4.	Windmill grass	Chevarakupul	<i>Chloris barbata</i>	Anarthaceae
5.	Purple love grass	Bunchgrass	<i>Eragrostis spectabilis</i>	Poaceae
6.	Narrow leaf cat tail	Sambu	<i>Typcha angustifolia</i>	Typhaceae
7.	Water grass	Mukkukorei	<i>Bulbostylis barbata</i>	Cyperaceae
8.	Engrothia	Pullu	<i>Eragrostis ferruginea</i>	Poaceae
9.	Marvel grass	Marvel grass	<i>Dichanthium annulatum</i>	Poaceae
10.	Tropical crab grass	Crab grass	<i>Digitaria adscendens</i>	Poaceae
11.	Common needle grass	.	<i>Aristida adscensionis</i>	Poaceae
Cactus				
1.	Prickly pear	Nagathali	<i>Opuntia</i>	Cactaceae

Source:

- Nair N.C and A.N. Henry, Flora of Tamil Nadu 1983, Series I, Botanical Survey of India, Southern Circle.
- Species observation in the field study and secondary data.

3.5.8 Flora Composition in the Buffer Zone

3.5.8.1 Calculation of species diversity by Shannon – wiener Index, Evenness and richness

The 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 the biodiversity index increases both when the number of types increases and when evenness increases. For a given number of types of species, the value of a biodiversity index is maximized when all types of species are equally abundant. Interpretation of Vegetation results in the study area is given below.

3.5.8.2 Species Diversity

Shannon Diversity Index has been used for estimating the diversity among the eight sampling sites to highlight the most diverse site, and calculate the Shannon Wiener diversity index of each site using the formula:

$$H' = - \sum P_i \ln P_i$$

Where, H' = Shannon index of diversity

S = Number of individuals of one species

$$P_i = \frac{S_i}{N}$$

N = Total number of all individuals in the sample

TABLE 3.27: TREES

H' (Shannon Diversity Index) = 3.34

Vernacular Name	Scientific Name	No of Species	Pi	In Pi	Pi x In (Pi)
Pereatchai	<i>Phoenix sylvestris</i>	16	0.036951501	-1.432367914	-0.052928145
Velikatthaan	<i>Prosopis juliflora</i>	51	0.11778291	-0.92891772	-0.109410632
Thennai maram	<i>Cocos nucifera</i>	10	0.023094688	-1.636487896	-0.037794178
Vembu	<i>Azadirachta indica</i>	15	0.034642032	-1.460396637	-0.050591108
Nuna maram	<i>Morinda tinctoria</i>	35	0.080831409	-1.092419852	-0.088301836
Elanthai maram	<i>Ziziphus mauritiana</i>	9	0.020785219	-1.682245387	-0.034965839
Pongam	<i>Millettia pinnata</i>	13	0.030023095	-1.522544544	-0.045711499
Wunja	<i>Albizia amara</i>	5	0.011547344	-1.937517892	-0.022373186
Thailam maram	<i>Eucalyptus tereticornis</i>	14	0.032332564	-1.490359861	-0.048187155
Panai maram	<i>Borassus flabellifer</i>	12	0.027713626	-1.55730665	-0.043158614
Savunda	<i>Leucaena leucocephala</i>	8	0.018475751	-1.733397909	-0.032025827
Shisham	<i>Dalbergia sissoo</i>	2	0.004618938	-2.335457901	-0.010787334
Flame of Forest	<i>Butea monosperma</i>	9	0.020785219	-1.682245387	-0.034965839
Kudukapuli	<i>Pithecellobium dulce</i>	10	0.023094688	-1.636487896	-0.037794178
Poovarasam	<i>Thespesia Populnea</i>	6	0.013856813	-1.858336646	-0.025750623
Cemmayir Konra	<i>Delonix regia</i>	3	0.006928406	-2.159366642	-0.01496097
Ezhumuchaipalam	<i>Citrus lemon</i>	2	0.004618938	-2.335457901	-0.010787334
Naval maram	<i>Syzygium cumini</i>	11	0.025404157	-1.595095211	-0.040522049
Karuvellam	<i>Acacia nilotica</i>	26	0.060046189	-1.221514548	-0.073347294
Manjal Konrai	<i>Cassia siamea</i>	8	0.018475751	-1.733397909	-0.032025827
Mandarai	<i>Bauhinia purpurea</i>	5	0.011547344	-1.937517892	-0.022373186
Koyya	<i>Psidium guajava</i>	5	0.011547344	-1.937517892	-0.022373186
Kuthirapidukkan	<i>Sterculia foetida</i>	2	0.004618938	-2.335457901	-0.010787334
Kondramaram	<i>Samanea saman</i>	5	0.011547344	-1.937517892	-0.022373186
Manjal Konnai	<i>Sennaslamea</i>	10	0.023094688	-1.636487896	-0.037794178
Maramalli	<i>Millingtonia hortensis</i>	2	0.004618938	-2.335457901	-0.010787334
Vaagai	<i>Albizia lebbek</i>	4	0.009237875	-2.034427905	-0.018793791

Moongil	<i>Bambusoideae</i>	9	0.020785219	-1.682245387	-0.034965839
Vadamaram	<i>Terminaliacatappa</i>	4	0.009237875	-2.034427905	-0.018793791
Thekku	<i>Tectona grandis</i>	14	0.032332564	-1.490359861	-0.048187155
Kodaivelam	<i>Acacia planifrons</i>	8	0.018475751	-1.733397909	-0.032025827
Ten pazham	<i>Muntingia calabura</i>	6	0.013856813	-1.858336646	-0.025750623
Karuveppilai	<i>Murraya koenigii</i>	1	0.002309469	-2.636487896	-0.006088887
Kalli	<i>Euphorbia antiquorum</i>	5	0.011547344	-1.937517892	-0.022373186
Nellai	<i>Phyllanthus acidus</i>	2	0.004618938	-2.335457901	-0.010787334
Iyalvagai	<i>Peltophorumpterocarpum</i>	2	0.004618938	-2.335457901	-0.010787334
Athi Maram	<i>Ficus Carica</i>	12	0.027713626	-1.55730665	-0.043158614
Manga	<i>Mangifera indica</i>	8	0.018475751	-1.733397909	-0.032025827
Alamaram	<i>Ficus benghalensis</i>	7	0.016166282	-1.791389856	-0.028960113
Murungai Maram	<i>Moringa oleifera</i>	2	0.004618938	-2.335457901	-0.010787334
Savukku maram	<i>Casuarina equisetifolia</i>	3	0.006928406	-2.159366642	-0.01496097
Perungondrai	<i>Delonix elata</i>	4	0.009237875	-2.034427905	-0.018793791
Sappotta	<i>Manilkarazapota</i>	4	0.009237875	-2.034427905	-0.018793791
Vilvam	<i>Aegle marmelos</i>	6	0.013856813	-1.858336646	-0.025750623
Nelli	<i>Phyllanthus emblica</i>	3	0.006928406	-2.159366642	-0.01496097
Koyya	<i>Psidium guajava</i>	3	0.006928406	-2.159366642	-0.01496097
Ilavamaram	<i>Ceibapentandra</i>	4	0.009237875	-2.034427905	-0.018793791
Sitapalam	<i>Annona squamosa</i>	2	0.004618938	-2.335457901	-0.010787334
Velvelam	<i>Acacia leucophloea</i>	3	0.006928406	-2.159366642	-0.01496097
Pappali maram	<i>Carica papaya</i>	5	0.011547344	-1.937517892	-0.022373186
Vazhaimaram	<i>Musa acuminata</i>	7	0.016166282	-1.791389856	-0.028960113
Palamaram	<i>Artocarpus heterophyllus</i>	3	0.006928406	-2.159366642	-0.01496097
Puliyamaram	<i>Tamarindus indica</i>	8	0.018475751	-1.733397909	-0.032025827
Total		433			-1.567446836

TABLE 3.28: SHRUBS

H (Shannon Diversity Index) = 3.26

Vernacular Name	Scientific Name	No of Species	Pi	In Pi	Pi x In (Pi)
Avarai	<i>Senna auriculata</i>	7	0.014373717	-1.842430921	-0.02648258
Arivalmanai poondu	<i>Sida acuta</i>	37	0.075975359	-1.119327237	-0.085041289
Neiveli Kattamani	<i>Ipomoea carnea</i>	17	0.034907598	-1.45708004	-0.050863164
Adayoti	<i>Triumfetta rotundifolia</i>	6	0.012320329	-1.909377711	-0.023524161
Nochi	<i>Vitex negundo</i>	6	0.012320329	-1.909377711	-0.023524161
Kaatamanaku	<i>Jatropagossypifolia</i>	24	0.049281314	-1.30731772	-0.064426335
Adhatoda	<i>Justicia adhatoda</i>	2	0.004106776	-2.386498966	-0.009800817
Kolunchi	<i>Tephrosia purpurea</i>	30	0.061601643	-1.210407706	-0.074563103
Surai lantai	<i>Ziziphus oenoplia</i>	10	0.020533881	-1.687528961	-0.034651519
Erukku	<i>Calotropis gigantea</i>	34	0.069815195	-1.156050044	-0.080709859
Mayil Kontai	<i>Caesalpinia pulcherrima</i>	3	0.006160164	-2.210407706	-0.013616475
Malaisundai	<i>Solanum pubescens Willd</i>	2	0.004106776	-2.386498966	-0.009800817
Nattam Takarai	<i>Cassia occidentalis</i>	11	0.022587269	-1.646136276	-0.037181723
Maruthani	<i>Lawsonia inermis</i>	1	0.002053388	-2.687528961	-0.00551854
Oosithagarai	<i>Cassia tora</i>	11	0.022587269	-1.646136276	-0.037181723
Sundaika	<i>Solanum torvum</i>	6	0.012320329	-1.909377711	-0.023524161
Seemai karuvelam	<i>Prosopis juliflora</i>	11	0.022587269	-1.646136276	-0.037181723
Chaturakalli	<i>Euphorbia antiquorum</i>	6	0.012320329	-1.909377711	-0.023524161
Manjarali Sonnapatti	<i>Tecoma stans</i>	2	0.004106776	-2.386498966	-0.009800817
Nandiar vattai	<i>Tabernaemontana coronaria</i>	2	0.004106776	-2.386498966	-0.009800817
Ottarchedi	<i>Xanthium indicum</i>	11	0.022587269	-1.646136276	-0.037181723
Thael kodukkukaai	<i>Martynia annua</i>	15	0.030800821	-1.511437702	-0.046553523
Kaakithapoo	<i>Bougainvillea spectabilis</i>	4	0.008213552	-2.08546897	-0.017129109
Sinduram	<i>Ixora coccinea</i>	1	0.002053388	-2.687528961	-0.00551854

Umathai	<i>Datura metel</i>	9	0.018480493	-1.733286452	-0.032031988
Narielandai	<i>Ziziphus nummularia</i>	7	0.014373717	-1.842430921	-0.02648258
Amanakku	<i>Ricinus communis</i>	8	0.016427105	-1.784438974	-0.029313166
Mulaga	<i>Capsicum frutescense</i>	5	0.01026694	-1.988558957	-0.020416416
Chemparuthi	<i>Hibiscus rosa-sinensis</i>	4	0.008213552	-2.08546897	-0.017129109
Perattikkirai	<i>Corchorus olitorius</i>	28	0.057494867	-1.24037093	-0.071314961
KanakAmbaram	<i>Crossandra infundibuliformis</i>	1	0.002053388	-2.687528961	-0.00551854
Malaialali	<i>Plumeria alba</i>	2	0.004106776	-2.386498966	-0.009800817
Seemai nayarooovi	<i>Stachytarpheta indica</i>	15	0.030800821	-1.511437702	-0.046553523
Thottalchinungi	<i>Mimosa pudica</i>	9	0.018480493	-1.733286452	-0.032031988
Marul-umattai	<i>Xanthium strumarium</i>	5	0.01026694	-1.988558957	-0.020416416
Thuthi	<i>Abutilon indicum</i>	33	0.067761807	-1.169015021	-0.07921457
Thakkali	<i>Lycopersicon esculentum</i>	2	0.004106776	-2.386498966	-0.009800817
Vellerukku	<i>Calotropis procera</i>	6	0.012320329	-1.909377711	-0.023524161
Kalvalai	<i>Canna indica</i>	2	0.004106776	-2.386498966	-0.009800817
Wild thulasi	<i>Hyptis suaveolens</i>	40	0.082135524	-1.08546897	-0.089155562
Nari-y-ilantai	<i>Zizyphus nummularia</i>	8	0.016427105	-1.784438974	-0.029313166
Kattukkathir	<i>Capparis sepia</i>	2	0.004106776	-2.386498966	-0.009800817
Arali	<i>Nerium indicum</i>	3	0.006160164	-2.210407706	-0.013616475
Thirukalli	<i>Euphorbia tirucalli</i>	2	0.004106776	-2.386498966	-0.009800817
Unni chedi	<i>Lantana camara</i>	10	0.020533881	-1.687528961	-0.034651519
seiyavruvi	<i>Aerva javanica</i>	27	0.055441478	-1.256165197	-0.069643656
Total		487			-1.476432718

TABLE 3.29: HERBS

H (Shannon Diversity Index) = 3.4

Vernacular Name	Scientific Name	No of Species	Pi	In Pi	Pi x In (Pi)
Nai kadugu	<i>Celome viscosa</i>	18	0.030201342	-1.519973755	-0.045905248
Kuppamani	<i>Acalypha indica</i>	24	0.040268456	-1.395035018	-0.056175907
Kavali	<i>Tephrosia purpurea</i>	18	0.030201342	-1.519973755	-0.045905248
Kattuttakarai	<i>Senna occidentalis</i>	8	0.013422819	-1.872156273	-0.025129614
Vellai tuduvalai	<i>Solanum trilobatum</i>	6	0.010067114	-1.997095009	-0.020104983
Kupanti	<i>Physalis minima</i>	8	0.013422819	-1.872156273	-0.025129614
Nattai-churi	<i>Borreria hispida</i>	24	0.026845638	-1.571126277	-0.042177887
Malai Kizhanelli	<i>Phyllanthus urinaria</i>	16	0.026845638	-1.571126277	-0.042177887
Vishapoondur	<i>Parthenium hysterophorus</i>	42	0.070469799	-1.151996969	-0.081180994
Kundan	<i>Barleria prionitis</i>	7	0.011744966	-1.93014822	-0.022669526
Mayurkondrai	<i>Cassia tora</i>	6	0.010067114	-1.997095009	-0.020104983
Pumpillu	<i>Ageratum conyzoides</i>	5	0.008389262	-2.076276255	-0.017418425
Kuppaikerai	<i>Amaranthus viridis</i>	27	0.045302013	-1.343882496	-0.060880583
Katrzhai	<i>Aloe vera</i>	3	0.005033557	-2.298125005	-0.011567743
Aappakkoti	<i>Ageratum conyzoides</i>	5	0.008389262	-2.076276255	-0.017418425
Karisalankanni	<i>Eclipta prostrata</i>	32	0.013422819	-1.872156273	-0.025129614
Jelly Leaf	<i>Sida rhombifolia</i>	8	0.013422819	-1.872156273	-0.025129614
Kal-l-uruvi	<i>Ammania baccifera</i>	9	0.015100671	-1.82100375	-0.027498379
Arugampul	<i>Cynodon dactylon</i>	32	0.053691275	-1.270096281	-0.068193089
Marul-umattai	<i>Xanthium strumarium</i>	12	0.020134228	-1.696065014	-0.03414896
Pottakanchi	<i>Dipterocanthus prostratus</i>	5	0.008389262	-2.076276255	-0.017418425
Kalluruvi	<i>Ammania baccifera</i>	8	0.013422819	-1.872156273	-0.025129614
Seruppada	<i>Coldenia procumbens</i>	12	0.020134228	-1.696065014	-0.03414896
Kallurukki	<i>Scoparia dulcis</i>	10	0.016778523	-1.77524626	-0.029786011
Kiranti nayan	<i>Ruellia tuberosa</i>	12	0.020134228	-1.696065014	-0.03414896
kottai-k-karantai	<i>Sphaeranthus indicus</i>	3	0.005033557	-2.298125005	-0.011567743
Kanavachai	<i>Commelina benghalensis</i>	2	0.003355705	-2.474216264	-0.008302739
Kudiyotti	<i>Argemone mexicana</i>	3	0.005033557	-2.298125005	-0.011567743

Sirupulai	<i>Aerva lanata</i>	8	0.013422819	-1.872156273	-0.025129614
Thel kodukku	<i>Heliotropium indicum</i>	16	0.026845638	-1.571126277	-0.042177887
Poduthalai	<i>Phyla nodiflora</i>	5	0.008389262	-2.076276255	-0.017418425
Thumbai	<i>Leucas aspera</i>	24	0.040268456	-1.395035018	-0.056175907
Kollukkai Vela	<i>Tephrosia purpurea</i>	18	0.030201342	-1.519973755	-0.045905248
Pai perukki	<i>Euphorbia heterophylla</i>	2	0.030201342	-1.519973755	-0.045905248
Mukkarattai Keerai	<i>Boerhaavia diffusa</i>	3	0.005033557	-2.298125005	-0.011567743
Amman pacharisi	<i>Euphorbia hirta</i>	8	0.013422819	-1.872156273	-0.025129614
Reilpoondu	<i>Croton sparsiflorus</i>	24	0.040268456	-1.395035018	-0.056175907
Kunnakora	<i>Cyperus compressus</i>	4	0.006711409	-2.173186268	-0.014585143
Neermulli	<i>Hygrophila auriculata</i>	2	0.003355705	-2.474216264	-0.008302739
Karaisalankanni	<i>Eclipta alba</i>	5	0.008389262	-2.076276255	-0.017418425
Vishnukranthi	<i>Evolvulus alsinoides</i>	3	0.005033557	-2.298125005	-0.011567743
Mullukkurai	<i>Amaranthus spinosus</i>	8	0.013422819	-1.872156273	-0.025129614
Vendaka	<i>Abelmoschus esculentus</i>	3	0.005033557	-2.298125005	-0.011567743
Thulasi	<i>Ocimum tenuiflorum</i>	20	0.033557047	-1.474216264	-0.049470344
Paruppu chedi	<i>Polygala erioptera</i>	7	0.011744966	-1.93014822	-0.022669526
Thatha poo	<i>Tridax procumbens</i>	23	0.038590604	-1.413518424	-0.05454853
Tetkotukki	<i>Indian heliotrope</i>	5	0.008389262	-2.076276255	-0.017418425
Kattu Kadugu	<i>Cleome gynandra</i>	3	0.005033557	-2.298125005	-0.011567743
Vaadamalli	<i>Gomphrena globosa</i>	2	0.003355705	-2.474216264	-0.008302739
Vishnukranti	<i>Evolvulus alsinoides</i>	5	0.008389262	-2.076276255	-0.017418425
Nayuruvi	<i>Achyranthes aspera</i>	7	0.011744966	-1.93014822	-0.022669526
Payaverai	<i>Cassia occidentalis</i>	5	0.008389262	-2.076276255	-0.017418425
Keelaneeli	<i>Phyllanthus niruri</i>	6	0.010067114	-1.997095009	-0.020104983
Kanavalikkodi	<i>Ipomea hederifolia</i>	4	0.006711409	-2.173186268	-0.014585143
Chirutali	<i>Ipomea obscura</i>	5	0.008389262	-2.076276255	-0.017418425
Pinnaku keerai	<i>Malvastrum coromandelianum</i>	4	0.006711409	-2.173186268	-0.014585143
Vella ragu	<i>Enicostema axillare</i>	2	0.003355705	-2.474216264	-0.008302739
Total		596			-1.596754037

3.5.9. Interpretation

From the below, it can be interpreted that herb community has higher diversity. While the Shrubs community shows less diversity. It is also observed that most of the quadrates have controlled generation of plant species with older strands. Higher herb species diversity can be interpreted as a greater number of successful species and a more stable ecosystem where more ecological niches are available, environmental change is less likely to be damaging to the ecosystem as a whole. Species richness is high for herb community when compared with tree and shrubs.

There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. Apart from the proposed project area, there is agricultural land. Horticulture and agricultural land are untouched. There are no Rare, Endangered, and Threatened Flora species in the mining area and their surrounding study area. A list of floral species has been prepared based on a primary survey (site observations) and discussion with local people (Secondary data).

TABLE 3.30: OVERALL SHANNON'S DIVERSITY INDEX

Details	Shannon diversity index	Evenness	Average population size
Trees	3.34	0.904	9.45
Shrubs	3.26	0.885	10.9
Herbs	3.4	0.921	12.1

3.5.10 Rare and endangered floral species

According to the Botanical Survey of India No endemic, Rare, Endangered and Threatened (RET) species of flora were found in the study area.

3.5.11. Economically important Flora of the study area

3.5.11.1 Agricultural crops: Paddy, Maize is the main crop grown. Different fruits like Banana, papaya, mangoes, guava and vegetables like brinjal, drumsticks, onion, Coriander also grown by the local people.

Reference: District Agriculture Plan – Virudhunagar District

3.5.11.2. Medicinal species: The nearby area is also endowed with the several medicinal species which are commonly available in the shrub forest and waste lands. The common medicinal species of the region are *Asparagus racemosus* (satamulli), *Aegle marmelos* (golden apple), *Azadirachta indica* (Neem) etc.

3.5.12 Faunal Study

- Ground survey for fauna has been carried out by trekking and Line Transect method for identification of animals. Patch sampling was used for Amphibians, visual encountered methods were used for reptiles, and Aerial net was used for butterflies.
- For Avifauna, the Visual Encounter Survey (VES) technique was used in the Morning (05:30 to 09:30 hrs.) and Evening (16:30 to 19:00 hrs.) for the study of diversity.
- For Mammals, Reptiles, Amphibians, etc., species have been recorded by calls, droppings, burrows, pug marks, indirect species-specific evidence, inquiring from local people, and actual sightings.
- The survey was conducted just before dusk time to 10:30 hours for Nocturnal Animals. The light trap method was used to determine the insect diversity.
- Data on fishery were obtained from secondary sources in the study area visit to the local Fish market to conduct 'Basket Survey' to understand Ichthyofaunal diversity.

3.5.13. Part I Field Sampling Techniques

3.5.13.1 Transect walk – Birds

Six no transect lines with varying length (100m-300m) and fixed width (2m) were laid which cuts through the core and buffer areas of proposed site. The transect surveys were conducted from 0700 to 1100Hrs and 1430 to 1730Hrs (Bibby et al. 2000). All avifauna found along these transects were recorded for analysing the data. Counts were conducted while there is no heavy rain, mist or strong wind.

3.5.13.2 Modified Pollard Walk – for Butterflies

The Modified Pollard Walk (Pollard 1977, 1993, Walpole 1999) using fixed width transect walk method were employed to investigate butterfly spatial distribution, diversity and abundance at the different survey sites.

3.5.13.3 Visual Encounter Survey (VES) - reptiles and amphibians

VES is a time-constrained sampling technique (Campbell and Christman, 1982; Corn and Bury, 1990). It needs a systematic search through an area or habitat for a prescribed time period (Campbell and Christman, 1982). The result of VES is measured against the time spent for search. VES technique is one of the simplest methods, and an appropriate technique for both inventory and monitoring Herpetofauna (Heyer et al. 1994).

3.5.13.4 Observational methods- Mammals

For the purpose of recording mammals, we used two different observational techniques: (1) direct observations; and (2) recording of occurrences like holes, markings, scats, hairs, and spines (Menon 2003). For identification confirmations, photographs with a scale reference were used, and locations were recorded using a

portable GPS device. Indigenous knowledge particularly that of the locals, was occasionally employed to compile a preliminary list of species and/or aid in the recognition of indicators.

3.5.14 Fauna Composition in the Core Zone

During the study, it was found that the faunal diversity in the core site was limited to Butterflies, insects, and some species of mammals & and reptiles among them numbers of Insects 10, Reptiles 5, Mammals 3, and Avian 14. The core site has avifauna species like crow, Black drongo, White-breasted kingfisher, Koel, etc. None of these species are threatened or endemic in the study area and surroundings. There is no Schedule I species and 20 species are under Schedule IV according to the Indian Wildlife Act 1972. There are no critically endangered, endangered, vulnerable, and endemic species were observed.

TABLE 3.31: INVENTORY OF FAUNAL DIVERSITY IN THE CORE ZONE

Sl. No	Common Name	Scientific Name	Schedule list WLPC 1972
Insects			
1.	Common Tiger	<i>Danaus genutia</i>	NL
2.	Red-veined darter	<i>Sympetrum fonscolombii</i>	NL
3.	Tawny coster	<i>Danaus chrysippus</i>	Schedule IV
4.	House fly	<i>Musca domestica</i>	-
5.	Dragonfly	<i>Agriansp</i>	-
6.	Striped tiger	<i>Danaus plexippus</i>	Schedule IV
7.	Indian domino cockroach	<i>Therea petiverlana</i>	-
8.	Blue bug	<i>Chrysocoris purpureus</i>	-
9.	Grey pansy	<i>Junonia atlites</i>	LC
10.	Common Tiger	<i>Danaus genutia</i>	LC
Reptiles			
1.	Oriental garden lizard	<i>Calotes versicolor</i>	NL
2.	Indian forest skink	<i>Sphenomorphus indicus</i>	NL
3.	House lizards	<i>Hemidactylus flaviviridis</i>	Schedule IV
4.	Common Green Whip Snake	<i>Ahaistulla nasuta</i>	Schedule IV
5.	Mabuya carinata	<i>Brahminy skink</i>	-
Mammals			
1.	Indian Field Mouse	<i>Mus booduga</i>	Schedule IV
2.	Asian Small Mongoose	<i>Herpestes javanicus</i>	Schedule (Part II)
3.	Squirrel	<i>Funambulus palmarum</i>	Schedule IV
Aves			
1.	Rose-ringed parakeet	<i>Psittacula krameri</i>	Schedule IV
2.	Black drongo	<i>Dicrurus macrocercus</i>	Schedule IV
3.	Common myna	<i>Acridotheres tristis</i>	Schedule IV
4.	Blue-rock pigeon	<i>Colombalivia</i>	Schedule IV
5.	Small-blue kingfisher	<i>Alcedoatthis</i>	Schedule IV
6.	Pond heron	<i>Ardeolagravii</i>	Schedule IV
7.	Common quail	<i>Coturnix coturnix</i>	Schedule IV
8.	Asian koel	<i>Eudynamysscolopacea</i>	Schedule IV
9.	Shikra	<i>Accipiter badius</i>	Schedule IV
10.	Koel	<i>Eudynamys</i>	Schedule IV
11.	Cattle egret	<i>Bubulcus ibis</i>	Schedule IV
12.	House crow	<i>Corvus splendens</i>	Schedule IV
13.	White-breasted kingfisher	<i>Halcyon smyrnensis</i>	Schedule IV
14.	Black-rumped flameback	<i>Dinopium benghalense</i>	Schedule IV

*NL- Not listed, LC- Least Concern

(Sources: Species observation in the field study)

3.5.14 Inventory of Faunal Diversity in the Buffer Zone

As animals, especially vertebrates move from place to place in search of food, shelter, mate or other biological needs, separate lists for core and buffer areas are not feasible however, a separate list of fauna pertaining

to core and buffer zone are listed separately. Though there are no reserved forests in the buffer zone. As such there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species within the core or buffer area.

There are no Sanctuaries, National Parks, Tiger Reserve or Biosphere reserves or Elephant Corridor or other protected areas within 10 km radius of from the core area. It is evident from the available records, reports, and circumstantial evidence that the entire study area including the core and buffer areas were free from any endangered animals. There were no resident birds other than common bird species such as Red-whiskered Bulbul, Asian Koel, House crow, Black drongos, Crows, Pond heron etc.

The list of Mammals (*directly sighted animals & Secondary data) is given in table No.3.43. The list of bird species recorded during the field survey and literature from the study area are given in Table 3.44. The list of reptilian species recorded during the field survey and literature from the study area is given in Table 3.45. The list of insect species recorded during the field survey and literature from the study area are given in Table 3.46. The list of Butterflies species recorded during the field survey and literature from the study area are given in Table 3.47. It is apparent from the list that none of the species either spotted or reported is included in Schedule I of the Wildlife Protection Act. Similarly, none of them comes under the REET category.

Taxonomically a total of 103 species recorded were from the buffer zone area. Based on habitat classification the majority of species were birds 40, followed by Butterflies 20, Reptiles 16, Insects 16, Mammals 8, and Amphibians 4. There are five Schedule II species, one species is under the schedule III and seventy-one species are under Schedule IV according to the Indian Wildlife Act 1972. A total of 40 species of bird were sighted in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. There are no impacts on nearby fauna species.

Dominant species are mostly birds, butterflies, and insects, and four amphibian was observed during the extensive field visit *Sphaerotheca breviceps*, *Euphyctis hexadactylus*, *Bufo melanostictus*, etc. There is no Schedule I Species in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed.

**TABLE 3.32: LIST OF FAUNA & THEIR CONSERVATION STATUS, MAMMALS:
(*DIRECTLY SIGHTED ANIMALS & SECONDARY DATA)**

S.No	Scientific name	Common name	Family	IUCN/WPA Schedule
1.	<i>Rattus rattus</i>	House rat	Murids	LC – IV
2.	<i>Funambulus palmarum</i>	Indian Palm squirrel	Squirrel	LC – IV
3.	<i>Harpertes edwardii</i>	Indian grey mongoose	Mongoose	LC – IV
4.	<i>Lepus nigricollis</i>	Hare	Leporids	LC – IV
5.	<i>Rattus norvegicus</i>	Field mouse	Murids	LC – IV
6.	<i>Sorex caerulescens</i>	Common mush shrew	Soricidae	LC – IV
7.	<i>Sus scrofa</i>	Wild boar	Suidae	LC – III
8.	<i>Indian fox</i>	<i>Vulpus benfhalensis</i>	Canidae	LC – II

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

TABLE 3.33: LISTED BIRDS

Sl. No	Scientific Name	Common Name	Family	Schedule list WLP 1972
1.	<i>Psittaculakrameria</i>	Rose-ringed Parakeet	Psittaculidae	Schedule IV
2.	<i>Tachybaptusruficollis</i>	Little grebe	Podicipedidae	Schedule IV
3.	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Pycnonotidae	Schedule IV

4.	<i>Alcedo atthis</i>	Small blue Kingfisher	Alcedinidae	Schedule IV
5.	<i>Leptocoma zeylonica</i>	Purple Sunbird	Nectariniidae	Schedule IV
6.	<i>Leptocoma zeylonica</i>	Purple-rumped Sunbird	Nectariniidae	Schedule IV
7.	<i>Dicrurus macrocercus</i>	Two-tailed Sparrow	Dicruridae	Schedule IV
8.	<i>Ardeactinaria</i>	Grey heron	Ardeidae	Schedule IV
9.	<i>Bubulcus ibis</i>	Cattle egret	Ardeidae	Schedule IV
10.	<i>Acridotheres tristis</i>	Common myna	Sturnidae	Schedule IV
11.	<i>Coracias benghalensis</i>	Indian roller	Coraciidae	Schedule IV
12.	<i>Nycticorax nycticorax</i>	Night heron	Ardeidae	Schedule IV
13.	<i>Centropus sinensis</i>	Greater Coucal	Cuculidae	Schedule IV
14.	<i>Anthus rufulus</i>	Paddyfield Pipit	Motacillidae	Schedule IV
15.	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	Pycnonotidae	Schedule IV
16.	<i>Egretta garzetta</i>	Little Egret	Ardeidae	Schedule IV
17.	<i>Merops orientalis</i>	Green Bee-eater	Meropidae	Schedule IV
18.	<i>Francolinus pondicerianus</i>	Grey Francolin	Phasianidae	Schedule IV
19.	<i>Tringa ochropus</i>	Green Sandpiper	Scolopacidae	Schedule IV
20.	<i>Motacilla cinerea</i>	Grey Wagtail	Motacillidae	Schedule IV
21.	<i>Aegithina tiphia</i>	Common Iora	Aegithinidae	Schedule IV
22.	<i>Motacilla flava</i>	Yellow wagtail	Motacillidae	Schedule IV
23.	<i>Athene brama</i>	Spotted owl	Strigidae	Schedule IV
24.	<i>Passer domesticus</i>	House Sparrow	Passeridae	Schedule IV
25.	<i>Butastur teesa</i>	White-eyed Buzzard	Accipitridae	Schedule IV
26.	<i>Dicrurus macrocercus</i>	Black Drongo	Dicruridae	Schedule IV
27.	<i>Lanius cristatus</i>	Brown Shrike	Laniidae	Schedule IV
28.	<i>Prinia inornata</i>	Plain Prinia	Cisticolidae	Schedule IV
29.	<i>Streptopelia chinensis</i>	Spotted dove	Columbidae	Schedule IV
30.	<i>Accipiter badius</i>	Shikra	Accipitridae	Schedule IV
31.	<i>Lanius vittatus</i>	Bay-backed Shrike	Laniidae	Schedule IV
32.	<i>Eudynamis scolopacea</i>	Asian koel	Cuculidae	Schedule IV
33.	<i>Halcyon smyrnensis</i>	White-breasted kingfisher	Alcedinidae	Schedule IV
34.	<i>Dicrurus leucophaeus</i>	Ashy Drongo	Dicruridae	Schedule IV
35.	<i>Dinopium benghalense</i>	Black-rumped flameback	Picidae	Schedule IV
36.	<i>Corvus splendens</i>	House crow	Corvidae	Schedule IV
37.	<i>Corvus macrorhynchos</i>	Jungle crow	Corvidae	Schedule IV
38.	<i>Copsychus saularis</i>	Robin	Muscicapidae	Schedule IV
39.	<i>Ardeola grayii</i>	Pond heron	Ardeidae	Schedule IV
40.	<i>Coturnix coturnix</i>	Common quail	Phasianidae	Schedule IV

Reference: Biodiversity of Birds in Vembakottai Water Reservoir, Virudhunagar District, Tamil Nadu

Ali, S. (2002). The Book of Indian Birds (13th revised edition). Oxford University Press, New Delhi.

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TABLE 3.34: LIST OF REPTILES EITHER SPOTTED OR REPORTED FROM THE STUDY AREA

Sl. No	Scientific Name	Common Name	Family	Schedule list WLP 1972
1.	<i>Calotes versicolor</i>	Common Garden lizard	Agamid lizards	LC – IV
2.	<i>Bangarus caeruleus</i>	Common krait	Elapidae	LC – II
3.	<i>Gongylophis conicus</i>	Rough tailed Sand boa	Boidae	LC – IV
4.	<i>Hemidactylus flaviviridis</i>	House gecko	Geckos	LC – IV
5.	<i>Ahaetulla nasuta</i>	Common Green Whip Snake	Colubridae	LC – IV
6.	<i>Boiga spp</i>	Cat snake	Colubridae	---
7.	<i>Chameleon zeylanicus</i>	Indian chameleleon	Chameleons	LC – II
8.	<i>Daboia russelii</i>	Russels viper	Viperidae	LC – III
9.	<i>Lissemys punctata</i>	Indian mud turtle	Softshell turtles	LC – IV
10.	<i>Naja naja</i>	Indian Cobra	Elapid snakes	LC – II
11.	<i>Basiliscus vittatus</i>	Brown basilisk	Corytophanidae	-
12.	<i>Ophiodryx vernalis</i>	Smooth green snake	Colubridae	LC – IV

13.	<i>Ptyas mucosus</i>	Common rat snake	Colubrid Snakes	LC - IV
14.	<i>Dendrelaphis</i>	Common Bronzeback	Colubrid Snakes	LC - IV
15.	<i>Brahminy skink</i>	<i>Mabuya carinata</i>	Scincidae	LC - II
16.	<i>Varanus benagaiensis</i>	Udumbu	Varanidae	LC - IV

TABLE 3.35: LIST OF INSECTS EITHER SPOTTED OR REPORTED FROM THE STUDY AREA

Sl. No	Scientific Name	Common Name	Family	Schedule list WLP 1972
1.	<i>Agrion sp & Petalura sp</i>	Dragon fly	Anisoptera	LC - IV
2.	<i>Apis indica</i>	Honey bee	Apidae	LC - IV
3.	<i>Aranea sp</i>	Spider	Crambidae	LC - IV
4.	<i>Carausius sp</i>	Stick insect	Lonchodinae	LC - IV
5.	<i>Coccinella septempunctata</i>	Lady bird beetle	Coccinellidae	LC - IV
6.	<i>Coccinella septempunctat</i>	Seven-spot ladybird	Coccinellidae	LC - IV
7.	<i>Therea petiveriana</i>	Indian domino cockroach	Corydiidae	-
8.	<i>Hamitermes silvestri</i>	Termite	----	LC - IV
9.	<i>Hieroglyphus sp</i>	Grasshopper	Acrididae	LC - IV
10.	<i>Praying mantis</i>	Mantis religiosa	Mantids	LC - IV
11.	<i>Chrysocoris purpureus</i>	Blue bug	Scutelleridae	LC - IV
12.	<i>Scorpion</i>	<i>Palamnaeus swammerdam</i>	Scorpionoidea	LC - IV
13.	<i>Centipede</i>	<i>Scolopendra</i>	House Centipedes	LC - IV
14.	<i>Cicada sp</i>	Cicade	Cicadidae	LC - IV
15.	<i>Coenagrion sp & Ischnura</i>	Damsel fly	Coenagrionidae	LC - IV

TABLE 3.36: LIST OF BUTTERFLIES IDENTIFIED FROM THE PROJECT SITE AND THEIR CONSERVATION STATUS

Sl. No	Scientific Name	Common Name	IUCN Conservation Status
1.	<i>Junonia iphita</i>	Chocolate pansy	LC
2.	<i>Junonia orythia</i>	Blue pansy	LC
3.	<i>Phalanta phalantha</i>	Common Leopard	LC
4.	<i>Acraea terpsicore</i>	Tawny Coster	LC
5.	<i>Papilio polytes polytes</i>	Common Mormon	LC
6.	<i>Papilio polytes romulus</i>	Common Mormon	LC
7.	<i>Junonia lemonias</i>	Lime pansy	LC
8.	<i>Hypolimnasmisippus</i>	Danaid Egg fly	LC
9.	<i>Junonia hierta</i>	Yellow Pansy	LC
10.	<i>Junonia lemonias</i>	Lemon Pansy	LC
11.	<i>Euchrysops pandava</i>	Plain cupid	LC
12.	<i>Papilio demoleus demoleus</i>	Lime Butterfly	LC
13.	<i>Eurema hecabe</i>	Common grass yellow	LC
14.	<i>Danaus genutia</i>	Striped Tiger	LC
15.	<i>Everes lacturnus</i>	Indian Cupid	LC
16.	<i>Euploea core</i>	Common Crow	LC
17.	<i>Melanitis leda leda</i>	Common Evening Brown	LC
18.	<i>Jamides celenoceleno</i>	Common Cerulean	LC
19.	<i>Danaus chrysippus chrysippus</i>	Plain Tiger	LC
20.	<i>Pachliopta aristolochiae</i>	Common Rose	LC

(Sources: Species observation in the field study)



Phalanta phalantha



Junonia lemonias



Danaus chrysippus



Junonia iphita



Euploea core



Catopsilia pomona



Hypolimnys misippus



Eurema hecabe



Calotes versicolor



Therea petiveriana



Acridotheres tristis



Alcedo atthis

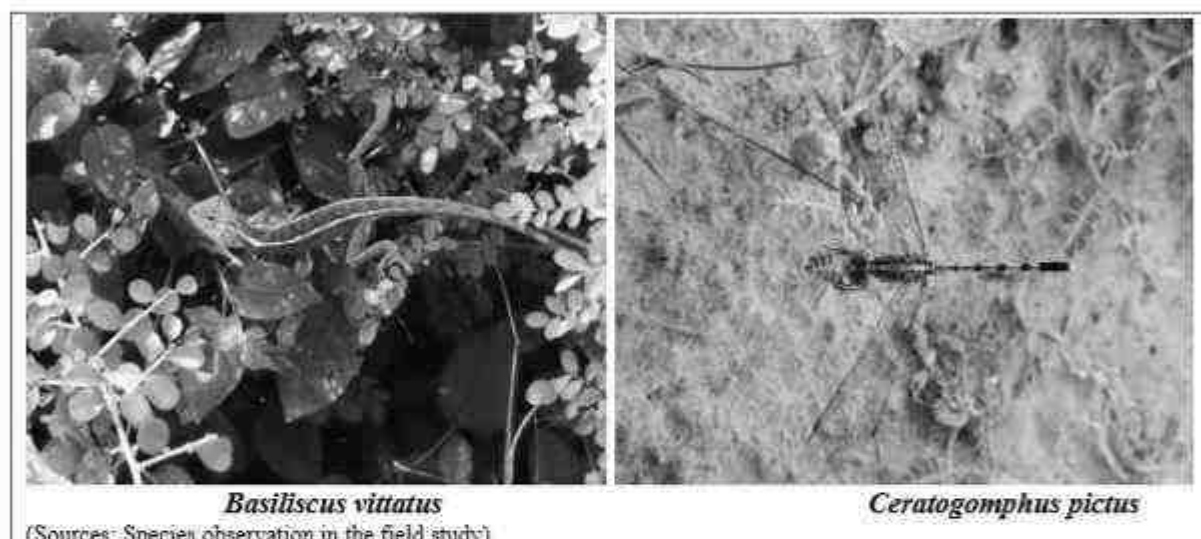


FIGURE 3.25: FAUNA SPECIES OBSERVATION IN THE BUFFER ZONE AREA

3.5.15 Aquatic Ecology

Mining activities will not have an impact on aquatic ecosystems because no effluent discharge from the Limestone mine is planned. There are no natural perennial surface water bodies, such as marshes, rivers, streams, lakes, or agricultural sites, inside the mining lease area. The study region contains a few seasonal bodies of water. There is no aquatic flora and, aquatic faun. Hence, it does not harbour any significant aquatic life. Therefore, the project is not likely to affect the aquatic ecology. Aquatic weeds are found to be growing everywhere in 10 km radius area, in every water bog, pond, etc. *Typha angustata* can be found growing all along the drains of villages, small water-logged depressions, and agricultural fields lacking water but containing enough moisture to support its growth. And where water is present, *Elchornia crassipes* has taken its roots and covers the entire water surface by its sprawl and invasion.

3.5.15.1. Objectives of Aquatic Studies

- ✓ Generating data through actual field collection in these locations over the study period; and
- ✓ Impacts on aquatic fauna/flora
- ✓ Consulted with locals to obtain knowledge about aquatic flora and animals.

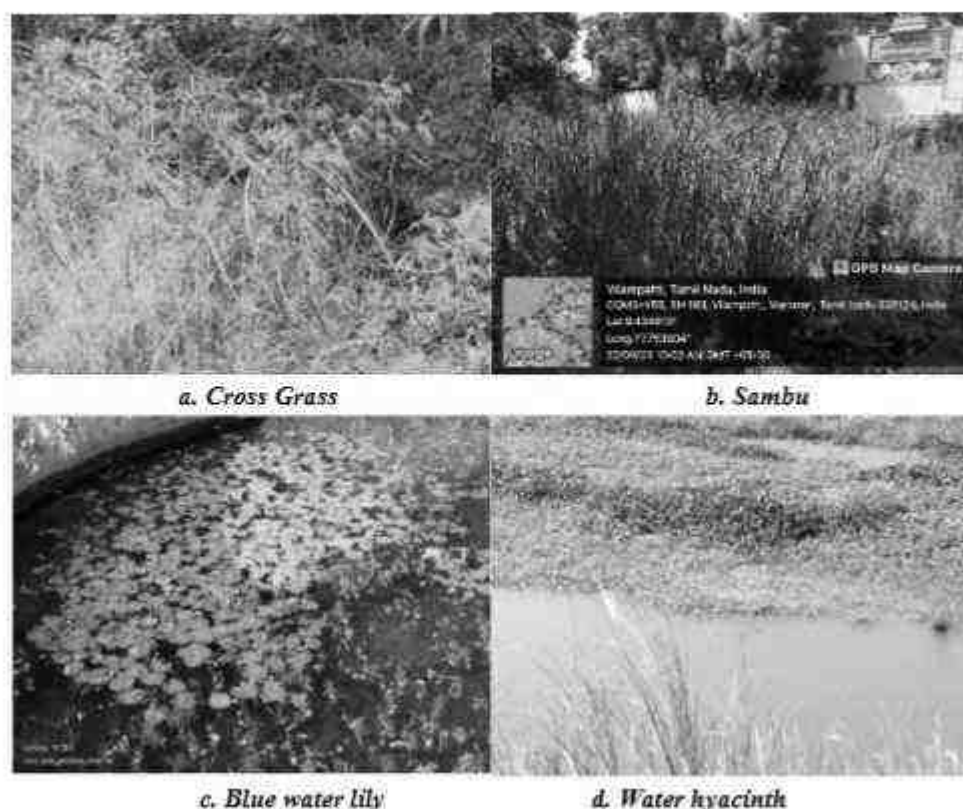
3.5.15.2. Macrophytes

The macrophytes observed within the study area are tabulated below.

TABLE 3.37: DESCRIPTION OF MACROPHYTES

Sl. No	Scientific name	Common Name	Vernacular Name (Tamil)	IUCN Red List of Threatened Species
1.	<i>Elchornia crassipe</i>	Water hyacinth	Agayatamarai	NA
2.	<i>Aponogeton natans</i>	Floating lace plant	Kottikizhnagu	NA
3.	<i>Nymphaea nouchali</i>	Blue water lily	Nellambal	LC
4.	<i>Typha angustifolia</i>	Sambu	Narrowleaf cattail	LC
5.	<i>Carex cruciata</i>	Cross Grass	Koraipullu	NA
6.	<i>Cyperus exaltatus</i>	Tall Flat Sedge	Koraikizhangu	LC

Sources: Species observation in the field study



(Sources: Species observation in the field study)

FIGURE 3.26: LIST OF AQUATIC PLANTS IN THE STUDY AREA**3.5.16. Aquatic Faunal Diversity**

Amphibian species like the common Indian Burrowing frog, and green pond frog, and etc. were sighted near the water bodies located in the study area.

TABLE 3.38: AMPHIBIANS OBSERVED/RECORDED FROM THE STUDY AREA

SL No	Common Name/English Name	Family Name	Scientific Name	Schedule list WLPA 1972	IUCN Red List data
1.	Indian Burrowing frog	Dicroglossidae	<i>Sphaerotheca breviceps</i>	Schedule IV	LC
2.	Green pond frog	Dicroglossidae	<i>Euphlyctis hexadactylus</i>	Schedule IV	LC
3.	Indian Toad	Bufonidae	<i>Bufomelanostictus</i>	Schedule IV	LC
4.	Skipper	Dicroglossidae	<i>Euphlyctiscynophlyctis</i>	Schedule IV	LC

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

3.5.17 Other Aquatic Fauna**3.5.17.1 Fishes**

The study area has low aquatic diversity, with few types of fish living. The species of fish reported during the primary visit are Rohu, Catla, Catfish, Snakehead murrel, etc.

TABLE 3.39: BASED ON ACTUAL SIGHTING, BASED ON INPUTS FROM LOCALS AND PERUSED FROM SECONDARY DATA

S.No	Common name	Scientific name	Family
1.	Pontia	<i>Puntius sophore</i>	Cyprinidae
2.	Catla	<i>Catla Catla</i>	Cyprinidae
3.	Silver scabbardfish	<i>Lepidopus caudatus</i>	Trichiuridae
4.	-	<i>Cyprinus carpio</i>	Cyprinidae
5.	Catfish	<i>Siluriformes</i>	-

6.	Rohu	<i>Labeo rohita</i>	Cyprinidae
7.	Eel fish	<i>Electrophorus electricus</i>	Gymnotidae
8.	Snakehead murrel	<i>Channa striata</i>	-

3.5.18 Conclusion

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

3.6 SOCIO ECONOMIC ENVIRONMENT

Socio-economic study is an essential part of environmental study. It includes demographic structure of the area, provision of basic amenities viz., housing, education, health and medical services, occupation, water supply, sanitation, communication, transportation, prevailing diseases pattern as well as feature like temples, historical monuments etc., at the baseline level. This will help in visualizing and predicting the possible impact depending upon the nature and magnitude of the project. It is expected that the Socio-Economic Status of the area will substantially improve because of this proposed project. As the proposed project will provide direct and indirect employment and improve the infrastructural facilities in that area and, thus, improve their standard of living.

3.6.1 STRUCTURE STUDY

There are few structures within the radius of 500m from the project site, the details of the structures are given below:

FIGURE 3.27: STRUCTURE MAP



3.6.2 Objectives of the Study

The objectives of the socio-economic study are as follows:

- To study the socio-economic status of the people living in the study area.
- To assess the impact of the project on Quality of life of the people in the study area.
- To recommend Community Development measures needs to be taken up in the study Area.

3.6.3 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

3.6.4 District Profile

Virudhunagar district is located in the southern part of Tamil Nadu. It has an area of 4241 sq kms. It was a part of Tirunelveli district before 1910, after which it became a part of Ramanathapuram district which is later trifurcated in to Ramanathapuram, Pasumpon Muthuramalinga Thevar and Kamarajar districts (G.O. Ms. No. 347, dated 8th March 1985).

The district is divided into two Revenue Divisions comprising four taluks each. The Aruppukkottai Revenue Division comprised of Kariapatti, Tiruchuli, Aruppukkottai and Virudhunagar taluks, and Sivakasi Revenue Division include Sattur, Sivakasi, Srivilliputhur and Rajapalayam taluks.

There are 6 Assembly Constituencies in the district. Rajapalayam Assembly Constituency is reserved for the Scheduled Castes. Aruppukkottai, Sattur, Virudhunagar, Sivakasi and Srivilliputhur are the other Assembly Constituencies

Village profile

Sundakottai is a village situated in the Aruppukkottai taluk of Virudhunagar district, Tamil Nadu. It is located approximately 12 km from the tehsil headquarters in Aruppukkottai and around 32 km from the district headquarters in Virudhunagar. Bommakottai serves as the Gram Panchayat for Sundakottai village.

As per Census 2011, the village code of Sundakottai is 641661. The village covers a total geographical area of 187.21 hectares and falls under the 626112 pincode.

Sundakottai village is governed under the Panchayati Raj system, with a Sarpanch serving as the elected head. For political representation, the village falls under the Tiruchuli Vidhan Sabha (Assembly) constituency and the Ramanathapuram Lok Sabha (Parliamentary) constituency.

TABLE 3.40: POPULATION DATA AROUND 5KM RADIUS

Sl. No.	Village Name	NO HH	Total Population	Male	Female	Total SC	Male SC	Female SC	Total ST	Male ST	Female ST	Total Literate Population	Male Literate	Female Literate	Total Illiterate Population	Male Illiterate	Female Illiterate	Total Workers
1	Aladipatti	708	2811	1433	1378	40	25	15	0	0	0	1913	1085	828	898	348	550	708
2	Athipatti	72	266	144	122	258	140	118	0	0	0	184	109	75	82	35	47	72
3	Bonmakottai	252	815	399	416	17	6	11	0	0	0	642	322	320	173	77	96	252
4	Chittalakundu	288	1132	583	549	0	0	0	0	0	0	684	425	259	448	158	290	288
5	Erasinnampatti	98	373	176	197	1	0	1	0	0	0	276	141	135	97	35	62	98
6	Kalayarkaraisakulam	603	1971	947	1024	299	148	151	0	0	0	1537	792	745	434	155	279	603
7	Kallorani	865	2798	1416	1382	427	213	214	0	0	0	2225	1203	1022	573	213	360	865
8	Kallumadam	338	1934	987	947	47	24	23	0	0	0	1430	799	631	504	188	316	338
9	Kalyanasundarapuram	63	240	108	132	0	0	0	0	0	0	166	79	87	74	29	45	63
10	Karupukkattiyendal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Keelalandamangalam	80	356	184	172	146	77	69	0	0	0	214	127	87	142	57	85	80
12	Konappanendal	167	618	313	305	0	0	0	0	0	0	439	255	184	179	58	121	167
13	Konganakurichi	174	575	282	293	107	44	63	0	0	0	414	222	192	161	60	101	174
14	Kulasekaranallur	729	2820	1408	1412	326	161	165	0	0	0	1890	1085	804	930	322	608	729
15	Kullampatti	196	855	431	424	11	5	6	0	0	0	676	369	307	179	62	117	196
16	Kurunakulam	185	641	329	312	221	110	111	0	0	0	442	247	195	199	80	117	185
17	Mandapasalai	1358	4691	2313	2378	9	4	5	3	1	2	3764	1977	1787	927	336	591	1358
18	Mangulam	1957	7106	3594	3511	2059	888	888	0	0	0	4719	2669	2050	2386	925	1461	1957
19	Melakandamangalam	544	2111	1098	1013	256	139	117	0	0	0	1542	855	687	569	243	326	544
20	Muthuramalingapuram	458	1591	820	771	2	2	0	0	0	0	1412	745	667	179	75	104	458
21	Muthuramalingapuram	350	1418	738	680	594	313	281	0	0	0	907	560	347	511	178	333	350
22	Nathampatti	280	1036	509	527	475	224	251	0	0	0	816	414	402	220	95	125	280
23	Parattanatham	23	93	41	52	0	0	0	0	0	0	61	31	30	32	10	22	23
24	Pillayar natham	93	327	158	169	2	1	1	0	0	0	236	126	110	91	32	59	93
25	Pillayarendal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	Puliyuran	664	2534	1291	1243	984	485	499	0	0	0	1619	940	679	915	351	564	664
27	Savasapuram	500	1800	887	913	257	131	126	0	0	0	1266	698	568	534	189	345	500
28	T. Karaisakulam	128	438	222	216	0	0	0	0	0	0	223	141	82	215	81	134	128
29	Thammanackkepatti	100	404	211	193	12	8	4	0	0	0	257	156	101	147	55	92	100
30	Tiruchuli	2438	9665	4863	4802	3556	785	771	8	4	4	6882	3761	3121	2783	1102	1681	2438
31	Udichiyendal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

32	Vadakkukoppuchithampatti	107	456	231	225	0	0	0	0	0	0	0	362	210	152	94	21	73	107
33	Vedantham	171	681	352	329	9	2	7	0	0	0	0	503	296	207	178	56	122	171

Sl. No.	Village Name	Male Workers	Female Workers	Total	Main Workers	Cultivation	Main Cultivation	Cultivation	Main Cultivation	Agriculture	Main Agriculture	Other Workers	Main Other Workers	Other Workers	Main Other Workers	Total
1	Aladipatti	807	775	1412	753	659	200	101	99	709	335	374	498	314	184	170
2	Athipatti	73	70	143	73	70	0	0	0	128	62	66	15	11	4	0
3	Borinakottai	213	219	430	213	217	41	12	29	229	102	127	160	99	61	2
4	Chittabakundu	345	180	250	193	57	11	10	1	56	42	14	178	139	39	275
5	Erasinnampatti	77	56	70	53	17	9	7	2	41	29	12	20	17	3	63
6	Kalayarkanisikulam	625	604	1150	598	552	100	51	49	647	283	364	367	241	126	79
7	Kallorani	804	591	1357	786	571	115	48	67	330	145	185	897	589	308	38
8	Kallumadam	586	543	1105	574	531	425	225	200	288	119	169	378	227	151	24
9	Kalyanasundarapuram	58	58	105	54	51	42	21	21	2	0	2	60	33	27	11
10	Karuppukattiyendal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Keelakandamangalam	98	83	179	97	82	59	29	30	52	18	34	66	49	17	2
12	Konappanendal	245	208	398	214	184	102	51	51	121	51	70	173	112	61	55
13	Konganakurichi	178	180	340	173	167	220	120	100	63	16	47	53	37	16	18
14	Kulasekaranallur	851	638	1411	835	576	250	125	125	340	127	213	803	575	228	78
15	Kullampatti	268	180	433	260	173	43	23	20	104	55	49	263	169	94	15
16	Kurunakulam	206	151	338	198	140	41	25	16	112	61	51	181	110	71	19
17	Mandapasalai	1346	1096	2275	1317	958	640	350	290	632	222	410	958	716	242	167
18	Mangulam	2151	1559	3476	2034	1442	311	178	133	1127	610	517	2016	1230	786	234
19	Melakandamangalam	647	292	917	644	273	14	10	4	111	44	67	783	583	200	22
20	Muthuramalingapuram	483	443	885	455	430	431	215	216	134	50	84	288	181	107	41
21	Muthuramalingapuram	448	383	499	275	224	35	27	8	388	202	186	75	45	30	332
22	Narthampatti	295	220	370	232	138	3	0	3	230	136	94	128	91	37	145
23	Parattanatham	28	21	33	21	12	0	0	0	33	21	12	0	0	0	16
24	Pillayar natham	127	125	68	54	14	0	0	0	49	40	9	19	14	5	184
25	Pillayarendal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	Puliyuran	753	567	819	511	308	20	15	5	348	178	170	450	318	132	501

27	Savasapuram	553	320	850	543	307	31	22	9	138	57	81	671	461	210	23
28	T.Karisaikulam	136	121	257	136	121	32	18	14	118	51	67	107	67	40	0
29	Thannanackampatti	135	117	236	132	104	44	27	17	90	27	63	102	78	24	16
30	Tiruchuli	2773	1704	3575	2453	1112	194	139	55	1280	664	616	2010	1600	410	902
31	Udichiyendal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	Vadakkokoppuchithampatti	138	133	267	137	130	2	1	1	245	128	117	20	8	12	4
33	Vedanatham	232	179	144	96	48	6	4	2	61	31	30	76	60	16	267

TABLE 3.41: COMMUNICATION & TRANSPORT FACILITIES IN THE STUDY AREA

Sl	Village Name	PO	SPO	PTO	T	PCO	MP	IC/ CSC	PCF	BS	PBS	RS	NH	SH	MDR	BTR	GR	NWR	FP
1	Aladipatti	2	1	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
2	Athipatti	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	1	2	1
3	Bommakottai	2	1	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
4	Chittalakundu	2	2	2	1	2	1	2	2	1	1	2	2	1	1	1	1	2	1
5	Erasimampatti	2	2	2	2	2	1	2	2	1	2	2	2	2	2	2	1	2	1
6	Kalayarkarisaikulam	2	1	2	1	2	1	2	1	1	1	2	2	2	1	1	1	2	1
7	Kallorani	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	1
8	Kallumadam	2	1	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
9	Kalyanasundarapuram	2	2	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	1
10	Karuppukkattiyendal																		
11	Keelakandamangalam	2	2	2	2	2	1	2	2	1	2	2	2	2	2	1	1	2	1
12	Konappanendal	2	2	2	1	2	1	2	2	1	2	2	2	2	2	1	1	2	1
13	Konganakunchi	2	2	2	1	1	1	2	2	2	1	2	2	2	2	1	1	2	1
14	Kulasekaranaalur	2	2	2	1	1	1	2	1	1	1	2	2	1	1	1	1	2	1
15	Kullampatti	2	2	2	1	1	1	2	2	1	1	2	2	2	1	1	1	2	1
16	Kurunaikulam	2	2	2	1	1	1	2	2	2	1	2	2	2	2	1	1	2	1
17	Mandapasalai	2	1	2	1	1	1	2	2	1	1	2	2	1	1	1	1	2	1
18	Mangulam	2	2	2	1	2	1	2	2	1	2	2	1	1	1	1	1	2	1
19	Meelakandamangalam	2	2	2	1	1	1	2	1	1	1	2	2	1	1	1	1	2	1

13	Konganakurichi	2	2	2	2	2	2	1	1	1	2	2	1	1	1	1	1	1	1
14	Kulasakaranallur	2	2	2	2	2	2	1	1	1	2	1	1	1	1	2	1	1	1
15	Kullampatti	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
16	Kurunaikulam	2	2	2	2	2	2	2	1	2	2	2	2	2	1	1	1	1	1
17	Mandapasalai	2	2	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1
18	Mangulam	2	2	2	2	2	2	2	1	1	2	2	1	1	1	1	1	1	1
19	Melakandamarigalam	2	2	2	2	2	2	2	1	1	2	2	1	1	1	1	2	1	1
20	Muthuramalingapuram	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1
21	Muthuramalingapuram	2	2	1	1	1	1	2	2	2	2	2	1	1	1	1	1	1	1
22	Narthampatti	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	1
23	Parattanatham	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	1
24	Pillayar natham	2	2	2	2	2	2	2	1	2	2	2	1	2	2	1	2	1	1
25	Pillayarendal																		
26	Puliyuran	2	2	2	2	1	1	2	1	1	2	2	1	1	2	2	1	1	1
27	Savaspuram	2	2	1	1	1	1	2	2	1	2	2	1	2	1	1	1	1	1
28	T.Karaisaikulam	2	2	2	2	2	2	2	2	1	2	2	1	2	2	2	2	2	1
29	Thammanaikenpatti	2	2	2	2	2	2	2	2	1	2	2	1	2	2	1	2	2	1
30	Tiruchuli	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1
31	Udichiyendal																		
	Vadakkukoppuchithampati	2	2	2	2	2	2	2	1	2	2	2	2	1	2	2	2	2	1
32	ti	2	2	2	2	2	2	2	1	1	2	2	1	2	2	1	1	1	1
33	Vedanatham	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1

TABLE 3.44: EDUCATIONAL FACILITIES IN THE STUDY AREA

Sl	Village Name	PPS		PS		MS		SS		SSS		DC		EC		MC		MI		PT		VTS		SSD	
		G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P	G	P
1	Aladipatti	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	Athipatti	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	Bomma kottai	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
4	Chittalaikundu	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5	Erasinnampatti	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	Kalayarkaraisikulam	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7	Kallorani	1	2	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8	Kallumadam	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
9	Kalyanasundarapuram	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
10	Karuppukkattiyendal																								
11	Keelakandamangalam	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	Konappanendal	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
13	Konganaikurichi	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
14	Kula sekaranallur	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
15	Kulampatti	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16	Kurunakulam	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
17	Mandapasalai	1	1	1	1	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
18	Mangulam	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
19	Meelakandamangalam	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	Muthuramalingapuram	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	Muthuramalingapuram	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
22	Narthampatti	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
23	Parattanaatham	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
24	Pillaiyar natham	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
25	Pillayarendal																								
26	Puliyuran	1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

27	Savaspuram	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
28	T.Karisaikulam	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
29	Thammanaickenpatti	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
30	Tiruchuli	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31	Udichchiyendal																							
32	Vadakkukoppuchithampatti	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
33	Vedunatham	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

TABLE 3.45: MEDICAL FACILITIES IN THE STUDY AREA

Sl. No.	Village Name	CHC	PHC	PHSC	MCW	TBC	HA	HAM	D	VH	MHC	FWC	NGM-I/O
1	Aladipatti	0	0	1	0	0	0	0	0	0	0	0	0 a
2	Athipatti	0	0	0	0	0	0	0	0	0	0	0	0 b
3	Bonimakkottai	0	0	1	0	0	0	0	0	0	0	0	0 a
4	Chittalakundu	0	0	0	0	0	0	0	0	0	0	0	0 c
5	Erasinnampatti	0	0	0	0	0	0	0	0	0	0	0	0 a
6	Kalayarkaraisikulam	0	0	0	0	0	0	0	0	0	0	0	0 a
7	Kallorani	0	1	1	1	1	0	0	1	0	0	1	1
8	Kallumadam	0	0	0	0	0	0	0	0	0	0	0	0 a
9	Kalyanasundarapuram	0	0	0	0	0	0	0	0	0	0	0	0 b
10	Karuppukkattiyendal												
11	Keelakandamangalam	0	0	1	0	0	0	0	0	0	0	0	0 c
12	Konappanendal	0	0	0	0	0	0	0	0	0	0	0	0 c
13	Konganakurichi	0	0	0	0	0	0	0	0	0	0	0	0 b
14	Kulasekaranallur	0	0	1	0	0	0	0	0	0	0	0	0 b
15	Kullampatti	0	0	0	0	0	0	0	0	0	0	0	0 a
16	Kurunaikulam	0	0	0	0	0	0	0	0	0	0	0	0 a
17	Mandapasalai	1	1	1	1	1	0	0	1	1	0	1	1
18	Mangulam	0	0	0	0	0	0	0	0	0	0	0	0 b
19	Melakandamangalam	0	0	0	0	0	0	0	0	0	0	0	0 c
20	Muthuramalingapuram	0	0	0	0	0	0	0	0	0	0	0	0 c
21	Muthuramalingapuram	0	0	1	0	0	0	0	0	1	0	0	0 b

3.6.5 Basic Amenities

A better network of physical infrastructure facilities (well-built roads, rail links, irrigation, power and telecommunication, information technology, market-network and social infrastructure support viz. health and education, water and sanitation, veterinary services and co-operative) is essential for development of the rural economy.

A review of infrastructure facilities available in the area has been given on the basis of field survey. In this study the villages which fall within 10 km radius around the site has been covered. Infrastructure facilities available in the area are presented below.

All basic amenities Education (higher education, colleges, universities, medical college, Transport facilities, Railway station, Bus station area available in the district headquarters Virudhunagar.

3.6.6 Recommendation and Suggestion

- The main activities in the area are agriculture, quarry operation and Crushing units.
- Due to the project about 34 Nos of peoples will be benefitted directly due to employment and more than 50 Nos of peoples and Crushers will be benefitted through this project
- As part of CER activities proponent intends to spend Rs. 3.0 Lakhs.
- At the end of the life of the mine the mined-out pit will act as temporary reservoir, the collected rain water in the mine pit may utilized for the nearby agriculture lands.

Apart from the following general activities will be conducted

- Awareness program to be conducted to make the population aware to get education and a better livelihood.
- Vocational training programme can be organized to make the people self - employed, particularly for women and unemployed youth.
- On the basis of qualification and skills local community may be preferred. Long term and short-term employments can be generated.
- While developing an Action Plan, it is very important to identify the population who falls under the marginalized and vulnerable groups. So that special attention can be given to these groups with special provisions while making action plans.

3.6.7 Summary & Conclusion

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

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 GENERAL

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

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

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

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

- Land environment
- Soil environment
- Water Environment
- Air Environment
- Noise Environment
- Socio economic environment
- Biological Environment

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

4.1 LAND ENVIRONMENT:

4.1.1 Anticipated Impact

- 3.59.00 Ha of the land will be under mining site the Permanent or temporary change on land use and land cover will occur
- Movement of heavy vehicles sometimes cause problems to agricultural land, human habitations due to dust, noise and it also causes traffic hazards.
- Due to degradation of land by pitting the aesthetic environment of the core zone may be affected.
- Earthworks during the rainy season increase the potential for soil erosion and sediment laden water entering the water ways.
- If no due care is taken wash off from the exposed working area may choke the water course & can also causes the siltation of water course

4.1.2 Mitigation Measures

- The 3.59.00 Ha of the land will be converted into temporary reservoir which will full fill the water scarcity in the drought season and the nearby agriculture land will be benefitted by the supply of water
- About 1750 Nos of trees will be planted in the lease area and approach road will retain the eco system
- The mining activity will be gradual confined in blocks and excavation will be undertaken progressively along with other mitigative measures like phase wise development in the production
- Construction of garland drains all around the quarry pits and construction of silt trap 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.
- Fencing will be constructed before starting the mining operation and it will be maintained in the conceptual stage. Security will be posted round the clock, to prevent inherent entry of the public and cattle.

4.1.1.1 Soil Environment

Impact on Soil Environment

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

Mitigation Measures

- Garland drains will be constructed all around the project boundary to prevent surface flows from entering the quarry. 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 (Silt Pond). These trap sediments 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.

Waste Dump Management

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

4.2 WATER ENVIRONMENT

4.2.1 Anticipated Impact

- The major sources of water pollution normally associated due to mining and allied operations are:
 - 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
- Abstraction of water may lead to depletion of water table
- 2.4 KLD water will be utilized for the quarrying operation

4.2.2 Mitigation Measures

- Water for the quarrying operation such as sprinkling on haul roads, Greenbelt development will be sourced from the lower part of the mine pit which is specifically allotted to collect the rain water.
- Garland drain, settling tank will be constructed along the proposed mining lease area. The Garland drain will be connected to settling tank and sediments will be trapped in the settling traps and only clear water will be discharged out to the natural drainage
- Rainwater will be collected in sump in the mining pits and will be allowed to store and pumped out to surface setting tank of 15 m x 10m x 3m to remove suspended solids if any. This collected water will be judiciously used for dust suppression and such sites where dust likely to be generated and for developing green belt. The proponent will collect and judiciously utilize the rainwater as part of rainwater harvesting system.
- Periodic (every 6 month once) analysis of quarry pit water and ground water quality in nearby villages.
- Domestic sewage from site office & urinals/latrines provided in ML is discharged in septic tank followed by soak pits.
- Wastewater 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.

4.3 AIR ENVIRONMENT

4.3.1 Anticipated Impact

- During mining, at various stages activities such as excavation, drilling, blasting, and transportation of materials, particular matter (PM), gases such as Sulphur dioxide, oxides of Nitrogen from vehicular exhaust are the main air pollutants.

- Emissions of noxious gases due to incomplete detonation of explosive may sometimes pollute the air.
- The fugitive dust released from the mining operations may cause effect on the mine workers who are directly exposed to the fugitive dust.
- Simultaneously, the air-borne dust may travel to longer distances and settle in the villages located near the mine lease area.

4.3.2 Modelling of Incremental Concentration from all Proposed Projects

Wind erosion of the exposed areas and the air borne particulate matter generated by quarrying operation, and transportation are mainly PM₁₀ & PM_{2.5} and emissions of Sulphur dioxide (SO₂) & Oxides of Nitrogen (NO_x) due to excavation/loading equipment and vehicles plying on haul roads are the cause of air pollution in the project area.

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

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

Prediction of impacts on air environment has been carried out taking into consideration cumulative production all the quarries fall in the Cluster. Air environment and net increase in emissions by Open pit source modelling in AERMOD Software AERMOD 12.

4.3.2.1 Emission Estimation

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.

The general equation for emissions estimation is:

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

Where:

E = emissions;

A = activity rate;

EF = emission factor, and

ER =overall emission reduction efficiency, %

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

4.3.2.2 Frame work of Computation & Model details

Suspended Particulate Matter (SPM) is the major pollutant occurred during quarrying activities. The prediction included the impact of Excavation, Drilling, Blasting (Occasionally), loading and movement of vehicles

during transportation and meteorological parameters such as wind speed, wind direction, temperature, rainfall, humidity and Cloud cover.

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

TABLE 4.1: ESTIMATED EMISSION RATE

PM_{10}			
Activity	Source type	Value	Unit
Drilling	Point Source	0.099350603	g/s
Blasting	Point Source	0.002341354	g/s
Mineral Loading	Point Source	0.043808175	g/s
Haul Road	Line Source	0.002495776	g/s/m
Overall Mine	Area Source	0.076319674	g/s
So ₂	Area Source	0.001029563	g/s
Nox	Area Source	0.000107772	g/s

FIGURE 4.1: AERMOD TERRAIN MAP

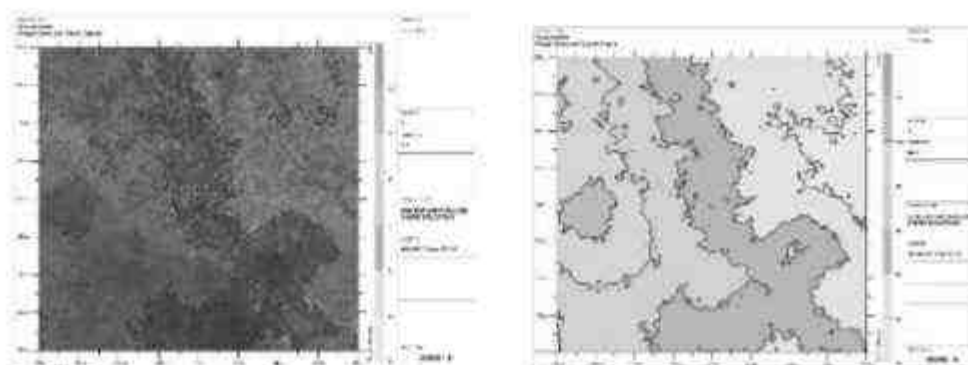


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM_{10}

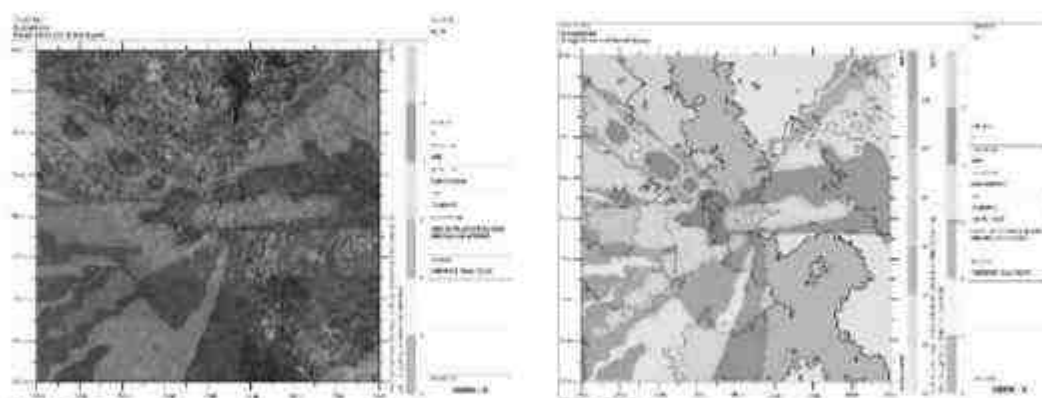


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF $PM_{2.5}$

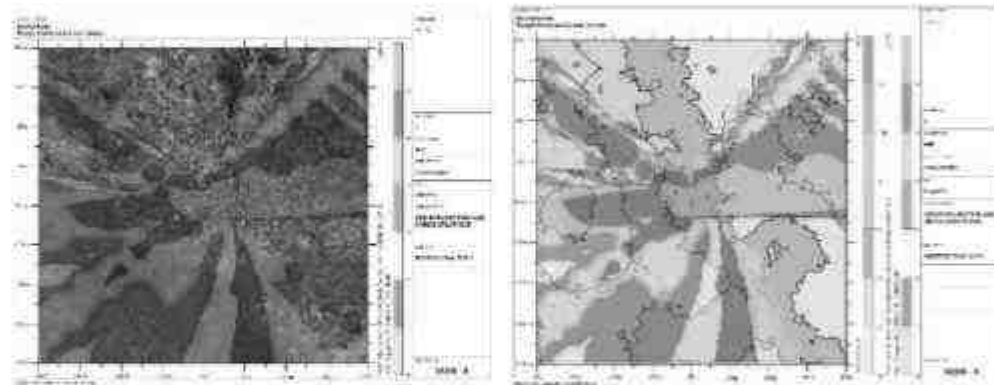


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NO_x

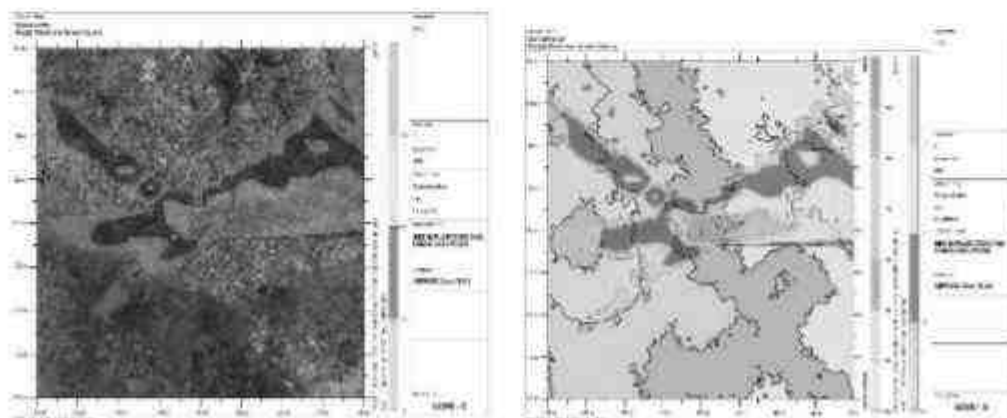


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF SO_2

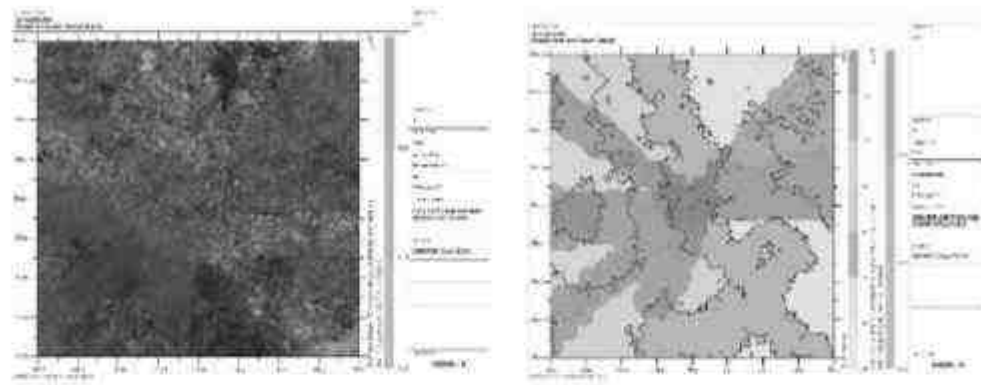
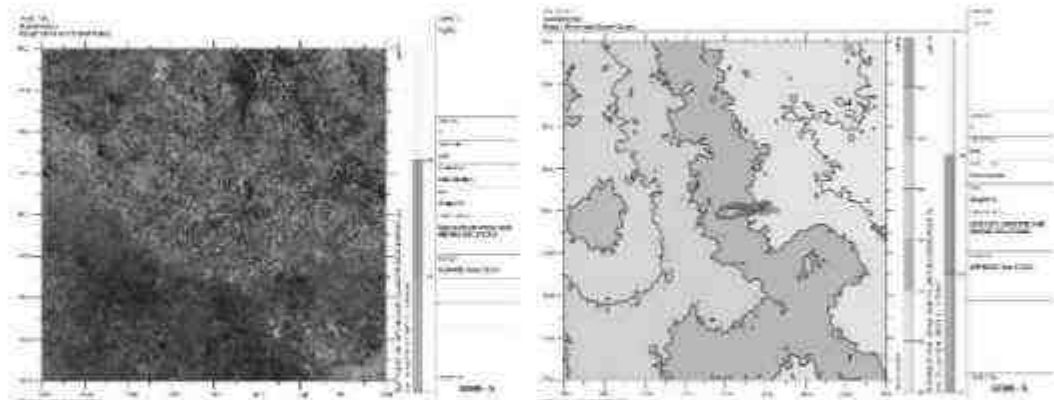


FIGURE 4.5A: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE



4.3.2.3 Model Results

The post project Resultant Concentrations of PM₁₀, PM_{2.5}, SO₂&NO_x (GLC) is given in Table below:

TABLE 4.2: INCREMENTAL & RESULTANT GLC OF PM₁₀

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM ₁₀ (µg/m ³)	Incremental value of PM ₁₀ due to mining (µg/m ³)	Total PM ₁₀ (µg/m ³)
AAQ1	9°28'22.76"N 78°10'49.14"E	-33	-18	39.7	15.67	55.37
AAQ2	9°28'32.69"N 78°11'4.85"E	448	296	39.4	15.46	54.86
AAQ3	9°27'52.02"N 78°10'7.91"E	-1301	-962	34.9	13.50	48.4
AAQ4	9°29'19.65"N 78°10'35.28"E	-462	1741	21.4	0	21.4
AAQ5	9°28'38.48"N 78°11'53.36"E	1939	469	42.3	15.20	57.5
AAQ6	9°25'42.61"N 78°12'26.84"E	2975	-4969	37.0	0	37.0
AAQ7	9°28'52.68"N 78° 8'31.90"E	-4079	2887	38.7	12.29	50.99

TABLE 4.3: INCREMENTAL & RESULTANT GLC OF PM_{2.5}

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM _{2.5} (µg/m ³)	Incremental value of PM _{2.5} due to mining (µg/m ³)	Total PM _{2.5} (µg/m ³)
AAQ1	9°28'22.76"N 78°10'49.14"E	-33	-18	24.1	8.79	32.89
AAQ2	9°28'32.69"N 78°11'4.85"E	448	296	24.1	8.54	32.64
AAQ3	9°27'52.02"N 78°10'7.91"E	-1301	-962	22.7	7.30	30
AAQ4	9°29'19.65"N 78°10'35.28"E	-462	1741	42.0	0	42.0
AAQ5	9°28'38.48"N 78°11'53.36"E	1939	469	22.7	8.22	30.92
AAQ6	9°25'42.61"N 78°12'26.84"E	2975	-4969	21.3	0.90	22.2
AAQ7	9°28'52.68"N 78° 8'31.90"E	-4079	2887	21.3	6.60	27.9

TABLE 4.4: INCREMENTAL & RESULTANT GLC OF SO₂

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline SO ₂ (µg/m ³)	Incremental value due to mining (µg/m ³)	Total SO ₂ (µg/m ³)
AAQ1	9°28'22.76"N 78°10'49.14"E	-33	-18	5.2	2.29	7.49
AAQ2	9°28'32.69"N 78°11'4.85"E	448	296	5.0	2.27	7.27
AAQ3	9°27'52.02"N 78°10'7.91"E	-1301	-962	6.0	2.20	8.2
AAQ4	9°29'19.65"N 78°10'35.28"E	-462	1741	6.1	0	6.1
AAQ5	9°28'38.48"N 78°11'53.36"E	1939	469	6.0	2.24	8.24
AAQ6	9°25'42.61"N 78°12'26.84"E	2975	-4969	6.0	0	6.0
AAQ7	9°28'52.68"N 78° 8'31.90"E	-4079	2887	6.2	2.00	8.2

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF NO_x

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline NO _x (µg/m ³)	Incremental value due to mining (µg/m ³)	Total NO _x (µg/m ³)
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AAQ1	9°28'22.76"N 78°10'49.14"E	-33	-18	19.7	11.60	31.3
AAQ2	9°28'32.69"N 78°11'4.85"E	448	296	19.7	11.39	31.09
AAQ3	9°27'52.02"N 78°10'7.91"E	-1301	-962	24.3	6.00	30.3
AAQ4	9°29'19.65"N 78°10'35.28"E	-462	1741	19.9	0	19.9
AAQ5	9°28'38.48"N 78°11'53.36"E	1939	469	21.2	11.15	32.35
AAQ6	9°25'42.61"N 78°12'26.84"E	2975	-4969	23.4	0	23.4
AAQ7	9°28'52.68"N 78° 8'31.90"E	-4079	2887	23.0	4.00	27

TABLE 4.6: INCREMENTAL & RESULTANT GLC OF FUGITIVE

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline NOx ($\mu\text{g}/\text{m}^3$)	Incremental value due to mining ($\mu\text{g}/\text{m}^3$)	Total NOx ($\mu\text{g}/\text{m}^3$)
AAQ1	9°28'22.76"N 78°10'49.14"E	-33	-18	61.35	28.00	89.35
AAQ2	9°28'32.69"N 78°11'4.85"E	448	296	61.35	19.00	80.35
AAQ3	9°27'52.02"N 78°10'7.91"E	-1301	-962	65.07	0	65.07
AAQ4	9°29'19.65"N 78°10'35.28"E	-462	1741	65.00	0	65.00
AAQ5	9°28'38.48"N 78°11'53.36"E	1939	469	63.90	7.00	63.90
AAQ6	9°25'42.61"N 78°12'26.84"E	2975	-4969	64.80	0	64.80
AAQ7	9°28'52.68"N 78° 8'31.90"E	-4079	2887	64.68	0	64.68

From the resultant of cumulative concentration i.e., Background + Incremental Concentration of pollutant in all the receptor locations without effective mitigation measures are still within the prescribed NAAQ limits of 100, 80 & 80 $\mu\text{g}/\text{m}^3$ for PM10, SO₂ & NO_x respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.3 Mitigation Measures

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

Advantages of Wet Drilling: -

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

Blasting –

- Establish time of blasting to suit the local conditions and water sprinkling on blasting face

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

Haul Road& Transportation –

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

Green Belt –

- 2500 trees will be planted along the safety barrier located in the leased area to prevent dust generation due to movement of tippers/trucks.
- Some trees will be planted along village road and nearby schools.

Occupational Health –

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

4.4 NOISE ENVIRONMENT

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks& HEMM. These activities will not cause any problem to the inhabitants of this area because there is no human settlement within 300m radius from the project site. Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities.

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

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

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

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

Where:

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

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

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

4.4.1 Anticipated Impact

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

- Source data
- Receptor data
- Attenuation factor

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

TABLE 4.7: ACTIVITY AND NOISE LEVEL PRODUCED BY MACHINERY

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

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

The total noise to be produced by mining machineries 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

Location ID	N1	N2	N3	N4	N5	N6	N7
Maximum Monitored Value (Day) dB(A)	48.4	48.4	53.1	54.2	55.1	52.9	51.2
Incremental Value dB(A)	60.1	60.1	46.1	23.8	23.6	24.8	25.0

Total Predicted Noise level dB(A)	60.4	60.4	53.9	54.2	55.1	52.9	51.2
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The incremental noise level is found within the range of 48.4dB (A) in Core Zone and 51.2-54.2 dB(A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations are within permissible limits of Industrial area (core zone) & Residential area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986).

4.4.2 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;
- 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 through training and awareness.
- Regular medical check-up and proper training to personnel to create awareness about adverse noise level effects

4.4.3 Ground Vibrations

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

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining lease area and may cause injury to persons or damage to the structures. Nearest habitation from the proposed project areas 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:

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

Where –

V = peak particle velocity (mm/s)

K = site and rock factor constant

Q = maximum instantaneous charge (kg)

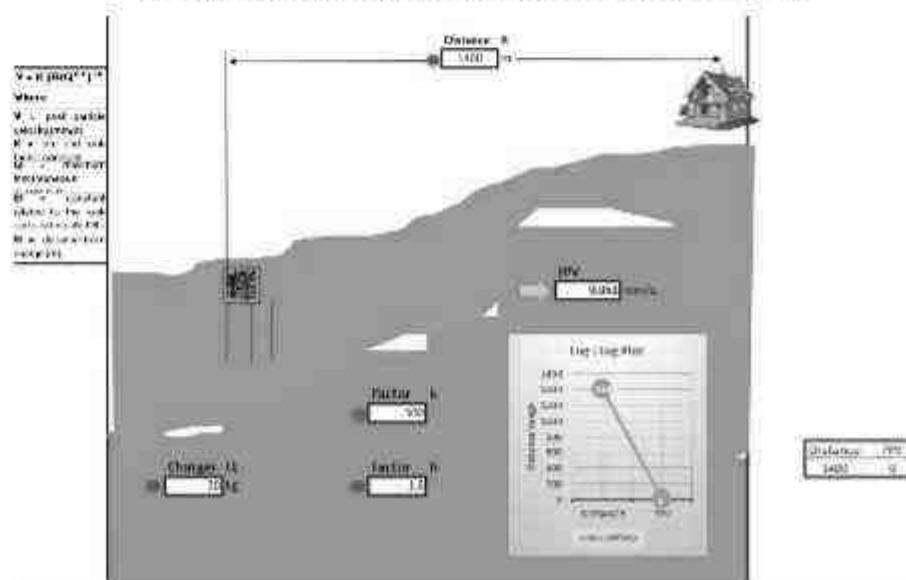
B = constant related to the rock and site (usually 1.6)

R = distance from charge (m)

TABLE 4.9: PREDICTED PPV VALUES DUE TO BLASTING

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in mm/s
P1	20	1400	0.024

FIGURE 4.6: GROUND VIBRATION PREDICTION



From the above graph, the charge per blast of 20 kg is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997. But the all the project proponent ensures that the charge per blast shall be carry out blasting twice or thrice a day based on the onsite conditions under the supervision of competent person employed. However, as per statutory requirement control measures will be adopted to avoid the impacts due to ground vibrations and fly rocks due to blasting.

Mitigation Measures

- It is proposed to carry out blasting operation 10kg per round so that the vibration will be minimal
- The mining operation will be carried out without deep hole drilling, 25mm small Di cartridge will be utilized for the blasting
- The blasting operations in the project site without deep hole drilling and blasting using delay detonators, which reduces the ground vibrations;

- Proper quantity of explosive, suitable stemming materials and appropriate delay system will be adopted to avoid overcharging and for safe blasting;
- Adequate safe distance from blasting will be maintained as per DGMS guidelines;
- Blasting shelter will be provided as per DGMS guidelines;
- Blasting operations will be carried out only during day time;
- The charge per delay will be minimized and preferably 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.
- The detonators will be connected in a predetermined sequence to ensure that only one charge is detonated at any one time and a NONEL or similar type initiation system will be used.
- The detonation delay sequence shall be designed so as to ensure that firing of the holes is in the direction of free faces so as to minimise vibration effects.
- Appropriate blasting techniques shall be adopted such that the predicted peak particle velocity shall not exceed 8 mm/s.
- Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices

4.5 ECOLOGY AND BIODIVERSITY

4.5. Impact on the Biological Environment

The developmental programs, policies, and projects operated or managed by government or private bodies can cause potentially significant changes in the physical, biological, and socio-economic environment. In some cases, the changes may be beneficial while in others they may be harmful to the environment. Accordingly, environmental impact studies are required for systematic identification, qualification, and interpretation of the anticipated changes.

4.5.1. Impact Identification and Evaluation

In general, impact prediction methods argue that the foremost step in impact appraisal must consider and identify project actions that are likely to bring significant changes in the project environment. Likely impacts identified were categorized into different levels like direct or primary and indirect or secondary impacts based on the influence of sources of impacts.

There is no National Park or Wildlife Sanctuary in the study area. In addition, No Biosphere Reserves, Wildlife corridors, or, Tiger / Elephant reserves within 10 km of the project area. No Schedule- I species were found in the buffer zone of the proposed project area during the biodiversity assessment.

4.5.2. Impact on Flora

The proposed projects areas are undulated terrain and it is not fit for cultivation. It is mostly devoid of any considerable vegetation. The proposed project area (core zone) does not encompass any designated forest land within

it. The vegetation is very sparse and scanty. So, there will be no impact on flora from the mining operation. There will not be much contamination of soil or any other materials from the mining operation. No threatened plant species were reported in the core and buffer study area during the field survey.

4.5.2.1. Anticipated Impact on agricultural land associated with flora

1. There are no impacts on the nearby agricultural land due to this mining activity.
2. None of the plants will be cut during the operational phase of the mine.
3. There shall be negligible air emissions or effluents from the project site. During the loading of the truck, dust generation will be likely. This shall be a temporary effect and not anticipated to affect the surrounding vegetation significantly.

Most of the land in the buffer area is undulating terrain with croplands, grass patches, and small shrubs. Hence, there will be no effect on the flora of the region.

4.5.3 Mitigation Measures

4.5.3.1. General Guidelines for Green Belt Development

In selecting plant species for green belt and plantation purposes in and around the proposed mine lease area native species, fruit-bearing trees, medicinal plants, and dense canopy trees should be selected. These species should be tolerant to pollution levels as per Bio- Geography zones of India.

After the operation of mining production capacity, green belt and Plantation species should be in accordance with the Terms and Conditions of the Environmental Clearance. Green belt is created not only for the purpose of protecting sensitive areas or maintaining the ecological balance but because they also act as efficient biological filters or sinks for particulate and gaseous emissions, generated by vehicular movements and various industrial and mining activities. Optimally designed green belts can be effective in reducing the impact of fugitive emissions and pollutants accidentally or otherwise released at ground levels.

4.5.3.2. Proposed Green Belt

Extensive green belt development will be started during the construction phase, which will continue till the operation of the plant. About 500-750 trees will be planted per hectare all around the plant, approach roads, and township premises. Locally available types of trees that are resistant to pollutants will be planted. In addition to the above, all open spaces available within the premises will be developed as nurseries, parks, gardens, and other forms of greenery. 5 m wide greenbelt will be developed along the plant premises, as per land available.

4.5.3.3. Guidelines & Techniques for Green Belt Development

An extensive survey of the project area was undertaken to observe the structure and composition of vegetation. Hence a combination of plants is selected depending upon the topographical suitability and species selected as per the SPCB Guideline and ToR. The soil characteristics were kept in mind. Based on this survey and environmental conditions suitable native plant species have been proposed for the green belt development plan.

Development of Green Belt

Table 4.10: LIST OF PLANT SPECIES PROPOSED FOR GREENBELT DEVELOPMENT

S. No	Scientific name	Tamil Name
1	<i>Aegle marmelos</i>	Vilva maram
2	<i>Albizia lebbbeck</i>	Vaagai maram
3	<i>Cassia fistula</i>	Konrai tree
4	<i>Lannea coromandelica</i>	Othiyam
5	<i>Limonia acidissima</i>	Vila maram
6	<i>Syzygium cumini</i>	Naval maram
7	<i>Toona ciliata</i>	Santhana Vembu
8	<i>Ficus hispida</i>	Aththi maram
9	<i>Borassus flabellifer</i>	Panai-maram
10	<i>Madhuca longifolia</i>	Illupai maram

(*Source: Term of Reference-ToR)

The plantation matrix adopted for the green belt development includes pit of 0.3 m x 0.3 m in size with a spacing of 2 m x 2 m. In addition, earth filling and manure may also be required for the proper nutritional balance and nourishment of the sapling. It is also recommended that the plantation has to be taken up randomly and the landscaping aspects could be taken into consideration. Multi-layered plantations comprising of medium height trees (7 m to 10 m) and shrubs (5 m height) are proposed for the green belt.

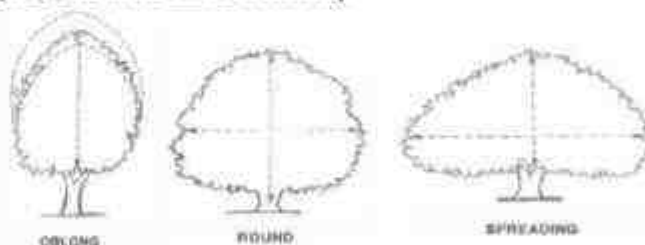
A greenbelt is a set of rows of trees planted in such a fashion, to create an effective barrier between the project and its surroundings. The greenbelt helps to capture fugitive emissions, attenuate the noise levels in the existing project, and simultaneously improve aesthetics of the surroundings.

4.5.3.4. Design of Green Belt

The present plan comprises the details of field investigations. Plant species for greenbelt development are selected as per CPCB guidelines. The greenbelt development plan has been formulated considering the parameters such as climate, soil types, topography, etc.

a. Characteristic features of plants to be used for Absorption of pollutant gases

- Plant species should be perennial and evergreen with thick canopy cover.
- The crown of the tree (mass of foliage/leaves and branches growing outward from the trunk of the tree) should be either Oblong, Round, or Spreading for effective absorption of pollutant gases.
- Plant should have foliage of longer duration.
- The foliage should be freely exposed through: Adequate height of crown, Openness of foliage/leaves in canopy, Big leaves (long and broad laminar surfaces).



(*Source: Guidance for Developing Green belts Manual, CPCB 2000)

Table 4.11: SPECIES SUITABLE FOR ABATEMENT OF NOISE AND DUST POLLUTION

S. No	Botanical name	Common name
1	<i>Azadirachta indica</i>	Vembhu maram
2	<i>Ficus religiosa</i>	Arasan maram
3	<i>Ficus hispida</i>	Aththi maram
4	<i>Bombax ceiba</i>	Mul Elavu
5	<i>Syzygium cumini</i>	Naval maram
6	<i>Tamarindus indica</i>	Puliyamaram
7	<i>Mangifera indica</i>	Manga maram
8	<i>Harwickia binata</i>	Anjan maram
9	<i>Delonix regia</i>	Neruppu Kondrai
10	<i>Cassia Fistula</i>	Sara Kondrai

(*Source: Guidance for Developing Green belts Manual, CPCB 2000)

The above-suggested list covers species with thick canopy cover, perennial green nature, native origin, and a large leaf area index. The proposed species will help in forming an effective barrier between the mine site area and the surroundings.

These species need to be planted along the periphery of the lease area for absorb fugitive emissions and noise levels which is generated during mining activities. All the open spaces, where tree plantation may not be possible, should be covered with shrubs and grass to prevent erosion of topsoil.

Some of the important aspects to be considered are:

- ✓ Planting of trees in each row will be in staggered orientation.
- ✓ In the front row, shrubs will be grown.
- ✓ Since the trunks of the tall trees are generally devoid of foliage, it will be useful to have shrubs in front of the trees so as to give coverage to this portion.
- ✓ The spacing between the trees will be maintained slightly less than the normal spaces, so that the trees may grow vertically and slightly increase the effective height of the green belt.

4.5.4. Anticipated Impact on Fauna

- Since the terrestrial fauna in the study area are distributed away from the mine site, the impacts of project are likely to be much low on terrestrial fauna of the region. The proposed mining lease area is devoid of any significant vegetation, it is not suitable for permanent habitat for any specific wildlife.
- Habitat degradation and disturbance to faunal group due to ground vibration and increase in noise level will be minimize or resolved by modern technologies. So, from above facts it is revealed that there will be no impact on fauna. No threatened fauna species reported in the core and buffer study area.

4.5.4.1. Measures for protection and conservation of wildlife species

- Topsoil has a large number of seeds of native plant species in the mining area.
- Topsoil will be used for restoration and suitable surfaces for planted seedlings.
- Checks and controls the movement of vehicles in and out of the mine.
- Undertaking mitigative measures for a conducive environment to the flora and fauna in consultation with Forest Department.
- A dust suppression system will be installed within the mine and periphery of the mine.

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

4.5.3. Impact on Aquatic Biodiversity

There is no natural perennial surface water body within the mine lease area, like wetlands, rivers streams, lakes, and farmer sites. There are few water bodies located in the study area. There are a few Odai and Canals located in the study area. There is no impact on fish habitats and the food WEB/ food chain in the water body and Reservoir. Aquatic biodiversity is observed in the study area.

4.5.4. Impacts on Bird Fauna:

The project does not involve any tree felling or removal of vegetation. Therefore, there may not be loss of nesting and roosting habitat of avian fauna.

4.5.5. Impacts on wildlife

There is no National Park, Wildlife Sanctuary, Biosphere Reserve, Wildlife corridors, and Tiger/Elephant Reserve found within 10 km radius of the project site.

Table 4.12: OVERALL ECOLOGICAL IMPACT ASSESSMENTS

S.No	Attributes	Assessment
1	Impact of mining activity on agricultural land nearby the proposed project site.	Agricultural land is located away from the proposed project site. There are no impacts on the agricultural land & Horticulture. Kindly refer to the conclusion.
	Activities of the project affect the breeding/nesting sites of birds and animals	No breeding and nesting site was identified in the mining lease site. The fauna sighted mostly migrated from the buffer area.
2	Located near an area populated by rare or endangered species	No Endangered, Critically Endangered, or vulnerable species were sighted in the core mining lease area.
3	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	There is no National Park/ Wildlife Sanctuary/ Reserve Forest/ Mangroves and Eco-Sensitive zone/ Critically polluted area/ HACA/CRZ located within 10 km radius of the area.
4	The proposed project restricts access to waterholes for wildlife	'No'
5	Proposed mining project impact surface water quality that also provides water to wildlife	'No' scheduled or threatened wildlife animals are sighted regularly core in the core area.
6	Proposed mining project increase siltation that would affect nearby biodiversity areas.	Surface runoff management such as drains is constructed properly so there will be no siltation effect in the nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities.	'No'
8	The project release effluents into a water body that also supplies water to a wildlife.	No water body near to core zone so the chances of water becoming polluted is low.
9	Mining projects affect the forest-based livelihood/ any specific forest product on which local livelihood depended.	'No'

10	The project likely to affect migration routes.	'No' 'migration route was observed during the monitoring period.
11	The project is likely to affect the flora of an area, which have medicinal value	'No'
12	Forestland is to be diverted, has carbon high sequestration.	'No' 'There was no forest land diverted.
13	The project is likely to affect wetlands, Fish breeding grounds, and marine ecology.	'No'. Wetland was not present in the near core Mining lease area. No breeding and nesting ground is present in the core mining area.

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

4.6 SOCIO ECONOMIC

4.6.1 Anticipated Impact

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

4.6.2 Mitigation Measures

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

4.7 OCCUPATIONAL HEALTH AND SAFETY

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

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

4.7.1 Respiratory Hazards

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

Physical Hazards

The following measures are proposed for control of physical hazards

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

4.7.2 Occupational Health Survey

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

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

Essential medicines will be provided at the site. The medicines and other test facilities will be provided at free of cost. The first aid box will be made available at the mine for immediate treatment. First aid training will be imparted to the selected employees regularly. The lists of first aid trained members shall be displayed at strategic places.

4.8 MINE WASTE MANAGEMENT

No waste is anticipated, the entire mined out material will be sold to needy crushers and customers.

4.9 MINE CLOSURE

The ultimate depth of the mine is 57m bgl and the life of the mine is 5 years, after completion of mining operation the following action will be taken in the project site as a part of Mine closure plan

- The total Mined out land would be around 3.59.00 Ha this land will be converted into temporary water reservoir which will facilitate to collect the rain water

- The stagnant water will be supplied to the nearby agriculture land during drought seasons
- Fencing will be re constructed around the pit after closure, the warning/ danger display board will be placed on all the sides of the project site
- The un utilized area and haul roads will be converted as plantation area, fruit bearing trees will be planted to retain the eco system of the area
- Final Mine closure plan will be prepared and submitted to the concerned authority

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.

As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have included most of the activities to be included in the closure plan. While formulating the closure objectives for the site, it is important to consider the existing or the pre-mining land use of the site; and how the operation will affect this activity.

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

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

4.9.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.9.1.1 Physical Stability

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

4.9.1.2 Chemical Stability

The solid wastes on the mine site should be chemically stable. This means that the consequences of chemical changes or conditions leading to leaching of metals, salts or organic compounds should not endanger public health and safety nor result in the deterioration of environmental attributes. If the pollutant discharges likely to cause adverse impacts is predicted in advance, appropriate mitigation measures like settling of suspended solids or passive treatment to improve water quality as well as quantity, etc., could be planned. Monitoring should demonstrate that there is no adverse effect of pollutant concentrations exceeding the statutory limits for the water, soil and air qualities in the area around the closed mine.

4.9.1.3 Biological Stability

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

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

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

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

5. ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.0 INTRODUCTION

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

5.1 FACTORS BEHIND THE SELECTION OF PROJECT SITE

The Rough Stone and Gravel Quarry Project for excavation of Rough Stone, which is site specific. The proposed mining lease areas have following advantages: -

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

5.3 FACTORS BEHIND SELECTION OF PROPOSED TECHNOLOGY

The existing quarries in the area operated by Opencast Mechanised Mining operation with drilling and blasting method will be used to extract Rough Stone in the area. All the applied mining lease area shave following advantages –

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

5.4 ANALYSIS OF ALTERNATIVE TECHNOLOGY

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

6. ENVIRONMENTAL MONITORING PROGRAMME

6.0 GENERAL

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

6.1 METHODOLOGY OF MONITORING MECHANISM

Implementation of EMP and periodic monitoring will be carried out by the project proponent. A comprehensive monitoring mechanism has been devised for monitoring of impacts due to this 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 Mine Management. On the other hand, implementation of area level protection measures like green belt development, environmental quality monitoring etc., are taken up by a senior executive who reports to their Mine Management.

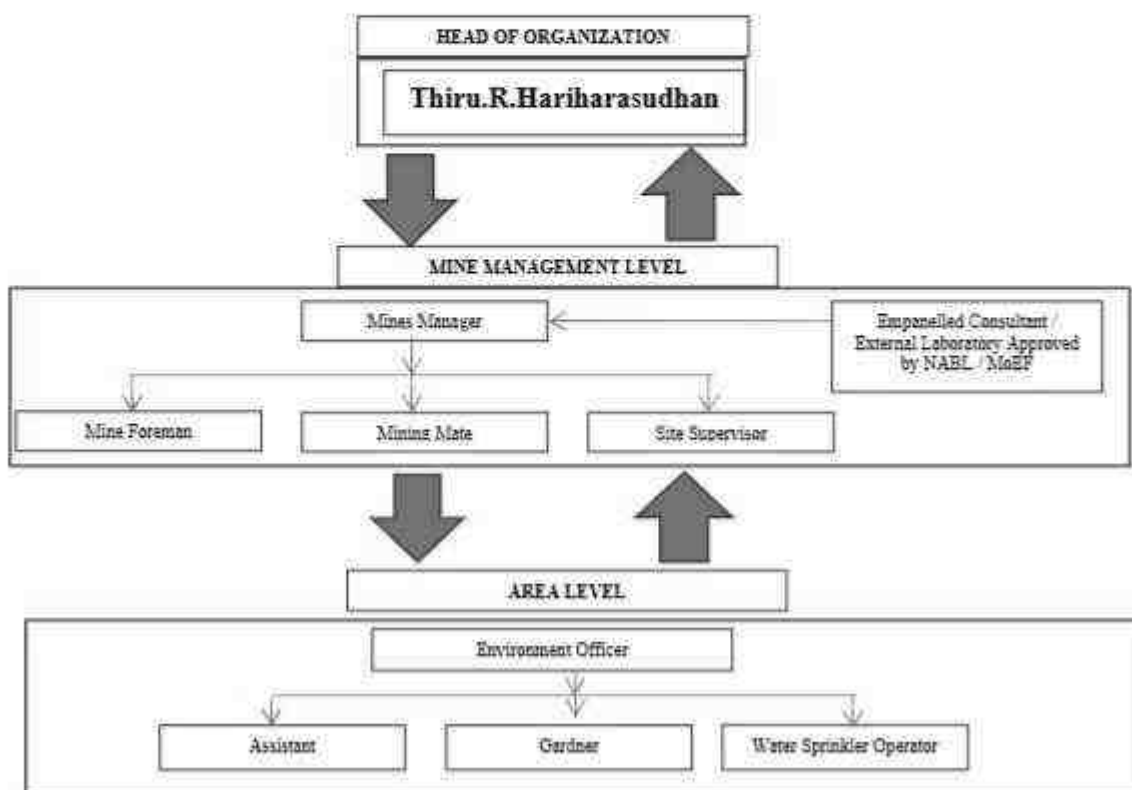
An Environment monitoring cell (EMC) will be constituted to monitor the implementation of EMP and other environmental protection measures in all the proposed quarries.

The responsibilities of this cell will be:

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

The environmental monitoring cell will co-ordinate all monitoring programs at site and data thus generated will be regularly furnished to the State regulatory agencies as compliance status reports. The sampling and analysis report of the monitored environmental attributes will be submitted to the Tamil Nadu Pollution Control Board (TNPCB) at a frequency of half-yearly and yearly by each proposed project proponent. The half-yearly reports are submitted to Ministry of Environment and Forest, Regional Office and SEIAA as well.

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

FIGURE 6.1: PROPOSED ENVIRONMENTAL MONITORING CELL

6.2 IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES

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

TABLE 6.1 IMPLEMENTATION SCHEDULE

SI 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

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

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

The details of monitoring are detailed in Table 6.2

TABLE 6.2: PROPOSED MONITORING SCHEDULE POST EC

S.No.	Environment Attributes	Location	Monitoring		Parameters
			Duration	Frequency	
1	Air Quality	2 Locations: (1 Core & 1 Buffer)	24 hours	Once in 6 months	Fugitive Dust, PM ₁₀ , PM _{2.5} , 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: (1 SW & 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 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 EMP

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

The proposed capital cost for Environmental Monitoring Programme is Rs 76,000/- per annum for Proposed Project.

TABLE 6.3 ENVIRONMENT MONITORING PROGRAM BUDGET

PROPOSAL			
Sl.No.	Parameter	Capital Cost	Recurring Cost per annum
1	Air Quality	Rs. 76,000/-	Rs. 76,000/-
2	Meteorology		
3	Water Quality		
4	Hydrology		
5	Soil Quality		
6	Noise Quality		
7	Vibration Study		
Total		Rs 76,000/-	Rs 76,000/-

Source: Approved Mining Plan

6.5 REPORTING SCHEDULES OF MONITORED DATA

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

Periodical reports to be submitted to: -

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

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

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

7. ADDITIONAL STUDIES

7.0 GENERAL

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

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

7.1. PUBLIC CONSULTATION

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

7.2 RISK ASSESSMENT

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

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

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

TABLE 7.1 RISK ASSESSMENT & CONTROL MEASURES

S. No	Risk factors	Causes of risk	Control measures
1	Accidents due to explosives and heavy mining machineries	Improper handling and unsafe working practice	All safety precautions and provisions of Mine Act, 1952, Metalliferous Mines Regulation, 1961 and Mines Rules, 1955 will be strictly followed during all mining operations; Workers will be sent to the Training in the nearby Group Vocational Training Centre Entry of unauthorized persons will be prohibited; Fire-fighting and first-aid provisions in the mine office complex and mining area;

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

7.	Failure of Mine Benches and Pit Slope	Slope geometry, Geological structure	Ultimate or over all pit slope shall be below 60° and each bench height shall be 5m height.
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Source: Analysed and proposed by FAE & EC

7.3 DISASTER MANAGEMENT PLAN

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

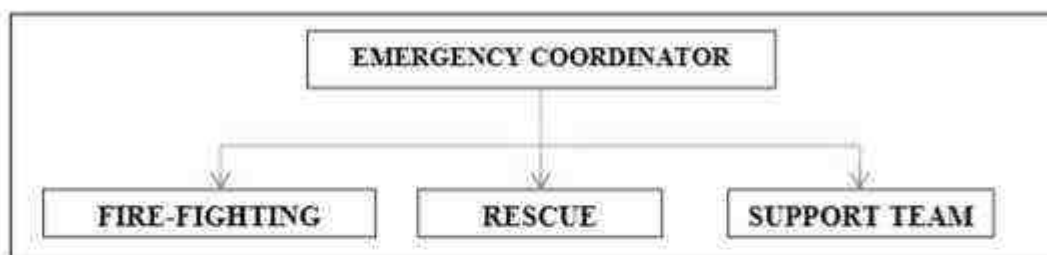
The Disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities.

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 and the coordination among key personnel and their team has been shown in Fig 7.1.

FIGURE 7.1: DISASTER MANAGEMENT TEAM LAYOUT



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

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION

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

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

Roles and responsibilities of emergency team –

(a) Emergency coordinator (EC)

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

(b) Incident controller (IC)

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

(c) Communication and advisory team

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

(d) Roll call coordinator

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

(e) Search and rescue team

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

(f) Emergency security controller

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

Emergency control procedure –

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

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

Proposed fire extinguishers at different locations –

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

TABLE 7.3: PROPOSED FIRE EXTINGUISHERS AT DIFFERENT LOCATIONS

LOCATION	TYPE OF FIRE EXTINGUISHERS
Electrical Equipment's	CO ₂ type, foam type, dry chemical powder type
Fuel Storage Area	CO ₂ type, foam type, dry chemical powder type, Sand bucket
Office Area	Dry chemical type, foam type

Alarm system to be followed during disaster –

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

7.4 CUMULATIVE IMPACT STUDY

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

TABLE 7.4: LIST OF QUARRIES WITHIN 500 METER RADIUS

CODE	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
PROPOSED QUARRY					
P1	Thiru. R. Hariharasudhan, S/o. Raja, No. 27, Guru Bhagavan Illam, Star Nagar 5 th Street, P and T Nagar Anasivur, Madurai North Taluk, Madurai District – 625 017	Sundakkottai	3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6	3.59.0 Ha	File No: 12955 ToR Identification No: TO25B0108TN59349 88N Dated: 29/12/2025
TOTAL EXTENT				3.59.0 Ha	
EXISTING QUARRY					
E-1	Thiru.S.Subbareddiar S/o, Kasthuri Reddhar 99, Keelakaranthai Kamatchi Chettiyar Street, South Street, Aruppukottai Taluk	Sundakkottai	46/1,46/2,46/3,46/4	1.29.50Ha	KV1/245/2020 Dated 22.05.2023
E-2	Thiru.T.R.Varadha Rajan 1, Ramasamy Nayakkar Street, Aruppukottai		48/12,48/13,48/14,50/ 2,50/3 (P) 50/4,50/5,50/6,50/11	2.22.50 Ha	KV1/737/2018 12.05.2022
E-3	Thiru. K.Bharathiraja S/o, Krishnan 78/M-33, Ajeesh Nagar, Thenvaldal Street, Aruppukottai Town and Taluk		26/6A,26/6B,26/6C,26/ 7,26/2A	0.80.50Ha	KV1/537/2019 Dated: 16.11.2021
E-4	Tmt.T.Muthulakshmi w/o Tamilselven 65/12/338, Kamaraj Nagar 2 nd Street, Paramakudy Ramanadhapuram District		100/6B,100/7,100/8,1 00/9,100/10,100/11	1.96.00 Ha	KV1/75/2021 Dated 13.04.2023
E-5	Thiru.K.Balamurugan		104/1A,104/1B1,104/ 1B2,104/2A,104/2B,1 04/3,104/4A1,104/4A 2,104/4B,104/4C,104/ 5A,104/5B,104/6A,10 4/6B,104/7A,104/7B, 104/8A,104/8B,104/8 C,104/8D,104/8E	3.02.50 Ha	KV1/030/2021 Dated 14.02.2025
E-6	Thiru.m.Thiruvappu S/o Muniasamy Devakurutchi Village Kadaladi Taluk, Ramanathapuram District.		64/3A,64/3B,64/3D,6 5/2A,65/2B,65/3A,65/ 6,66/1A1,66/1A2,66/1 B2,66/2A2,66/2B1,66 /2B2,67/3A1,65/3B1, 66/3B2,67/3A1,65/3B 1,66/3B2,66/1B1,66/2 A1,64/1B1,66/2A1,64 /6A,64/7A,64/6B,64/7 B	3.40.50	KV1/666/2020 06.06.2023
TOTAL CLUSTER EXTENT				12.71.5 Ha	
ABANDONED / EXPIRED QUARRY					
EXP-1	Thiru.P.Tamilselvam S/o Ramar 8/126, Madurai, Rameshwaram Road, Paramakudi, Ramanathapuram Taluk		3/8,3/9,3/10,3/11,3/12 A,3/12b, 3/12c,3/12d, 4/2,4/3,4/4A,4/4b,4/5, 4/6	3.59.0 Ha	25VNR0402658
TOTAL EXTENT				3.59.0 Ha	
TOTAL CLUSTER EXTENT				16.30.5 Ha	

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

TABLE 7.5: SALIENT FEATURES OF PROPOSAL “PI”

Name of the Project	Thiru. R.Hariharasudhan Rough stone and Gravel quarry	
S.F. No.	3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6	
Extent	3.59.0 Ha	
Village Taluk and District	Sundakkottai Village, Aruppukottai Taluk, Virudhunagar District	
Land Type	It is a Patta land – Punjai, registered in the name of the applicant (Thiru. R.Hariharasudhan), vide Patta No. 635,641 and 648.	
Toposheet No	58 – K-03	
Latitude between	09°28'18.1601"N to 09°28'27.3291"N	
Longitude between	78°10'47.0425"E to 78°10'53.1109"E	
Elevation of the area	95m AMSL	
Mining Plan period	5 Years	
Proposed Depth of Mining	57m bgl	
	Rough Stone in m³	Gravel in m³
Geological Resources	19,80,605	59,654
Mineable Reserves	7,40,985	50,060
Year wise Production	7,40,985	50,060
Peak Production	1,93,070	17,822
Ultimate Pit Dimension	XY-AB: 63m (L) X 107m (W) X 42m (D) BGL XY-CD: 181m (L) X 133m (W) X 57m (D) BGL	
Water Level in the region	118m bgl	
Method of Mining	Opencast Mechanized Mining Method is being carried out with 5.0-meter vertical bench with a bench width is not less than the bench height	
Topography	The lease applied area is almost plain topography. The area has gentle sloping towards Northwestern side and altitude of the area is 95m (max) above Mean Sea level. The area is covered by 2m thickness of Gravel and 2m thickness of weathered rock. Massive Charnockite which is clearly inferred from the existing quarry pit.	
Machinery proposed	Hand Jack Hammer	4 Nos
	Compressor	1 No
	Wagon Drill Machine	1 No
	Excavator with Bucket and Rock Breaker	2 Nos
	Trucks	5 Nos
	Water sprinkler	1 No
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	34 Nos	
Project Cost	Rs. 3,46,66,000/-	
CER Cost	Rs. 3,00,000/-	
Nearby Water Bodies	Odai	20m SE

	Odai	90m East
	Sundakollai Kanmoi	300m South
	Tank	350m North
	Tank	1.5km NE
	Gundar River	6km NE
	Odai	20m SE
Greenbelt Development Plan	Proposed to plant 1750 Nos of trees considering 500 Nos of trees/ Ha criteria The plantation will be developed around the project site and nearby village roads	
Proposed Water Requirement	2.4 KLD	
Nearest Habitation	1.3km – South East	
Nearest Reserve Forest	Vidathakulam R.F -15.3km-NE	
Nearest Wild Life Sanctuary	Kanjirankulam Birds Sanctuary – 34.5km - SE Chitrangudi Bird Sanctuary – 35.5km - SE	

TABLE 7.6: SALIENT FEATURES OF PROPOSAL “E1”

Name of the Quarry	Thiru. S.K.Subba Reddiar Rough stone and Gravel Quarry	
S.F.No	46/1, 46/2, 46/3 & 46/4	
Extent	1.29.5 Ha	
Toposheet No	58-K/3	
Latitude between	09°28'20.65"N to 09°28'25.83"N	
Longitude between	78°10'52.34"E to 78°10'57.25"E	
Proposed Depth of Mining	24m BGL	
Geological Resources	Rough Stone in m ³	Gravel m ³
	3,73,248	70,452
Mineable Reserves	Rough Stone in m ³	Gravel m ³
	99,038	47,640
Year wise production details	Rough Stone in m ³	Gravel m ³
	99,038	47,640
Water Level in the surrounds area	60m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is exhibits plain terrain. The area has gentle sloping towards south side and covered by grayish black cotton soil followed by weathered rock formation and massive charnockite rock formation.	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	10 Nos	
Project Cost	Rs. 52.16 lakhs	
CER Cost	Rs. 5.0 Lakhs	

Source: Approved Mining Plan

TABLE 7.7: SALIENT FEATURES OF PROPOSAL “E4”

Name of the Quarry	Tmt.T Muthulakshmi Rough stone and Gravel Quarry	
S.F.No	100/6B, 7,8,9,10,11	
Extent	1.96.0 Ha	
Toposheet No	58-K/3	

Latitude between	09°28'35.7"N to 09°28'40.4"N		
Longitude between	78°10'42.6"E to 78°10'32.10"E		
Proposed Depth of Mining	40m BGL		
Geological Resources	Rough Stone in m ³ 6,85,125	Gravel m ³ 78,300	Earth m ³ 19,575
Mineable Reserves	Rough Stone in m ³ 2,58,125	Gravel m ³ 61,100	Earth m ³ 15,275
Proposed production for five years plan period	Rough Stone in m ³ 2,58,125	Gravel m ³ 61,100	Earth m ³ 15,275
Water Level in the surrounds area	40m bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Topography	The lease applied area is exhibits plain terrain. The area has gentle sloping towards south side and covered by grayish black cotton soil followed by weathered rock formation and massive charnockite rock formation		
Machinery proposed	Jack Hammer	5 Nos	
	Compressor	2 No	
	Excavator	1 No	
	Tippers	6 Nos	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.		
Proposed Manpower Deployment	10 Nos		

TABLE 7.7A: SALIENT FEATURES OF PROPOSAL "E5"

Name of the Quarry	Thiru.K Balamurugan Rough stone and Gravel Quarry	
S.F.No	104/1A, 1B1, 1B2 Etc	
Extent	3.02.50 Ha	
Toposheet No	58-K/3	
Latitude between	09°28'39.40"N to 09°28'46.00"N	
Longitude between	78°10'50.70"E to 78°10'58.15"E	
Proposed Depth of Mining	46m BGL	
Proposed production for five years plan period	Rough Stone in m ³ 3,67,570	Gravel m ³ 1,23,924
Water Level in the surrounds area	68m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is exhibits plain terrain. The area has gentle sloping towards south side and covered by grayish black cotton soil followed by weathered rock formation and massive charnockite rock formation	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	15 Nos	

TABLE 7.7B: SALIENT FEATURES OF PROPOSAL "E6"

Name of the Quarry	Thiru.M.Thiruvappu Rough stone and Gravel Quarry	
S.F.No	64/3A,3B... Etc	
Extent	3.40.5 Ha	
Toposheet No	58-K/3	
Latitude between	09°28'07.09"N to 09°28'14.50"N	
Longitude between	78°11'4.71"E to 78°11'11.81"E	
Proposed Depth of Mining	26m BGL	
Proposed production for five years plan period	Rough Stone in m ³	Gravel m ³
	3,59,226	48,210
Water Level in the surrounds area	50m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is exhibits plain terrain. The area has gentle sloping towards south side and covered by grayish black cotton soil followed by weathered rock formation and massive charnockite rock formation	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	20 Nos	

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

Air Environment –

Calculating the Cumulative Load of Mining within the cluster is as shown in table 7.8 to 7.9.

TABLE 7.8: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE

Quarry	Year wise production (Five Years)	Per Year Production in m ³	Per Day Production in m ³	Number of Lorry Load Per Day
P1	7,40,985	1,48,197	494	41
Total	7,40,985	1,48,197	494	41
E1	99,038	19,807	66	5
E4	2,58,125	51,625	172	14
E5	3,67,570	73,514	245	20
E6	3,59,226	71,845	239	20
Total	10,83,959	2,16,791	722	59
Grand Total	18,24,944	3,64,988	1216	100

TABLE 7.9: CUMULATIVE PRODUCTION LOAD OF GRAVEL/ TOPSOIL

Quarry	Year wise production	Per Year Production in m ³	Per Day Production in m ³	Number of Lorry Load Per Day
P1	50,060	16,686	56	4
Total	50,060	16,686	56	4
E1	47,640	15,880	52	4
E4	61,100	20,366	67	5
E5	1,23,924	41,308	137	12
E6	48,210	16,070	54	5

Total	2,80,874	93,624	310	26
Grand Total	3,30,934	1,10,310	366	30

On a cumulative basis considering the proposed quarries, it can be seen that the overall production of Rough Stone is 486m³ per day with a capacity of 41 trips of Rough Stone per day and Gravel/Topsoil is 90m³ per day with a capacity of 8 trips of from the cluster.

Based on the above production quantities the emissions due to various activities in all the mines includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 7.10.

TABLE 7.10: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS

EMISSION ESTIMATION FOR QUARRY "P1"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit
	Drilling	Point Source	0.099350603	g/s
	Blasting	Point Source	0.002341354	g/s
	Mineral Loading	Point Source	0.043808175	g/s
	Haul Road	Line Source	0.002495776	g/s/m
	Overall Mine	Area Source	0.076319674	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.001029563	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000107772	g/s
EMISSION ESTIMATION FOR QUARRY "E1"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit
	Drilling	Point Source	0.082719084	g/s
	Blasting	Point Source	0.000936792	g/s
	Mineral Loading	Point Source	0.046118257	g/s
	Haul Road	Line Source	0.002504923	g/s/m
	Overall Mine	Area Source	0.045525939	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.00128133	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000040443	g/s
EMISSION ESTIMATION FOR QUARRY "E4"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit
	Drilling	Point Source	0.089130543	g/s
	Blasting	Point Source	0.001360652	g/s
	Mineral Loading	Point Source	0.049847809	g/s
	Haul Road	Line Source	0.002531702	g/s/m
	Overall Mine	Area Source	0.058113570	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.002672444	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000129110	g/s
EMISSION ESTIMATION FOR QUARRY "E5"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit
	Drilling	Point Source	0.110194728	g/s
	Blasting	Point Source	0.003930235	g/s
	Mineral Loading	Point Source	0.052046102	g/s
	Haul Road	Line Source	0.002558438	g/s/m
	Overall Mine	Area Source	0.074696159	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.004132776	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000311241	g/s
EMISSION ESTIMATION FOR QUARRY "E6"				
Estimated Emission Rate for PM ₁₀	Activity	Source type	Value	Unit

	Drilling	Point Source	0.083014762	g/s
	Blasting	Point Source	0.000953655	g/s
	Mineral Loading	Point Source	0.051078993	g/s
	Haul Road	Line Source	0.002545392	g/s/m
	Overall Mine	Area Source	0.075119321	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.003456077	g/s
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000281283	g/s

Source: Emission Calculation

TABLE 7.11: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM ₁₀ in µg/m ³	
Background	39.1
Incremental	12.77
Resultant	51.87
NAAQ Norms	100 µg/m ³
PM _{2.5} in µg/m ³	
Background	18.9
Incremental	5.82
Resultant	24.72
NAAQ Norms	60 µg/m ³
So ₂ in µg/m ³	
Background	4.7
Incremental	6.51
Resultant	11.21
NAAQ Norms	80 µg/m ³
No ₂ in µg/m ³	
Background	18.3
Incremental	1.1
Resultant	19.4
NAAQ Norms	80 µg/m ³

Noise Environment –

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

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

$$L_{p2} = L_{p1} - 20 \log (r_2/r_1) - A_{e1,2}$$

Where:

L_{p1} & L_{p2} are sound levels at points located at distances r_1 & r_2 from the source.

$A_{e1,2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$$L_{p_{total}} = 10 \log \{10^{(L_{p1}/10)} + 10^{(L_{p2}/10)} + 10^{(L_{p3}/10)} + \dots\}$$

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

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

TABLE 7.12: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER

Location ID	Background Value (Day) dB(A)	Incremental Value dB(A)	Total Predicted dB(A)	Industrial Standards dB(A)
P1	48.4	60.1	60.4	Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)
E1	46.1	37.8	46.7	
E4	43.2	27.0	43.3	
E5	41.6	24.3	41.7	
E6	42.5	25.3	42.6	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 48.4 dB (A) in Core zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations near habitations are within permissible limits of Residential Area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules were published in the Gazette of India, vide S.O.123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986).

Ground Vibrations

Ground vibrations due to mining activities in the all the 4 Mines within cluster are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc. However, the major source of ground vibration from each mine is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements nearby the mining areas and may cause injury to persons or damage to the structures. Nearest Habitations from each mine respectively are as in below.

TABLE 7.13: NEAREST HABITATION FROM EACH MINES

Location ID	Distance & Direction
P1	1.3 Km-SE
E1	1.44 Km-SE
E2	1.37 km-E
E3	570 m-SE
E4	1.57 km-SW
E5	1.74 Km-E
E6	1.60 Km-NE

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

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

Where -

V = peak particle velocity (mm/s)

K = site and rock factor constant

Q = maximum instantaneous charge (kg)

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

R = distance from charge (m)

TABLE 7.14: GROUND VIBRATIONS AT EACH MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in mm/s
P1	20	1.3Km-SE	0.057
E1	20	1.44 Km-SE	0.051
E4	20	1.57 km-SW	0.042
E5	20	1.74 Km-E	0.036
E6	20	1.60 Km-NE	0.041

Source: Blasting Calculations

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

Socio Economic Environment –

Each mine shall contribute towards CER and the community shall develop.

TABLE 7.15: SOCIO ECONOMIC BENEFITS

Location ID	Project Cost	CER
P1	Rs. 3,46,66,000/-/-	Rs. 3,00,000/-
Total	Rs. 3,46,66,000/-/-	Rs. 3,00,000/-

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 by all the mines.

TABLE 7.16: EMPLOYMENT BENEFITS FROM EACH MINES

Description	Employment
P1	34
Total	34
E1	10
E4	10
E5	15
E6	20
Total	55
Grand Total	89

A total of 34 people will get employment due to 1 proposed mine in cluster and remaining people are already employed at existing mines.

TABLE 7.17: GREENBELT DEVELOPMENT BENEFITS FROM EACH MINES

Code	No of Trees proposed to be planted	Area Covered Sq.m	Name of the Species
P1	1750	The safety zone along the boundary barrier has been identified to be utilized for Greenbelt development	Neem, Pongamia pinnata, Casuarina, etc.,
Total	1750		
E1	750		
E4	1000		
E5	1700		
E6	1800		
Total	5,250		
G. Total	7000		

For the proposed mining plan 1750 Nos of trees will be planted around lease area and approach road and 5,250 trees are planted for existing quarry.

7.5 PLASTIC WASTE MANAGEMENT PLAN

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

Objective –

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

TABLE 7.18: ACTION PLAN TO MANAGE PLASTIC WASTE

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

Source: Proposed by FAE's and EC

7.6 CLUSTER MANAGEMENT COMMITTEE

The cluster management committee is proposed to form including of 1 Proposed quarry and 6 Existing quarries total extent of the cluster is 16.30.50 Ha

In the cluster management committee, the following Environmental Management plan will be followed the activities such as

- Transportation of Minerals and blasting activities with the coordination between the individual quarry owners.
- Sprinkling of water regularly thrice a day in the mutual understanding with the quarry owners
- Carrying out blasting operation as specified times by the Mines Managers and as per the EIA report
- Usage of Haul roads in a time specified by the Cluster Management Committee
- Following Safe operating procedure prescribed by the Mines Manager during natural calamities
- Planting Trees in the Government Land, School and within the project site
- Celebrating Safety month, Environmental Month along with the Mines Managers in every six months once
- Regularly follow the health of the workers and take medical examination as per the DGMS norms under the guidance of Mines Manager
- Meet at Association Hall monthly once to review the Environmental Management and Safety activities prescribed by the Cluster Management Committee
- We have read and understood all the above steps and we ensure to follow these specific steps Quarry owners in the Cluster management committee

Quarries in the Cluster Management Committee

CODE	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
PROPOSED QUARRY					
P1	Thiru. R. Hariharasudhan, S/o. Raja, No. 27, Guru Bhagavan Illam, Star Nagar 5 th Street, P and T Nagar Anaivur, Madurai North Taluk, Madurai District – 625 017	Sundakkottai	3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6	3.59.0 Ha	File No: 12955 ToR Identification No: TO24B0108TN59349- 88N Dated: 29.12.2025
TOTAL EXTENT				3.59.0 Ha	
EXISTING QUARRY					
E-1	Thiru.S.Subbareddiar S/o, Kasthuri Reddiar 99, Keelakaranthai Kamatchi Chettiyar Street, South Street, Aruppukottai Taluk	Sundakkottai	46/1,46/2,46/3,46/4	1.29.50Ha	KV1/245/2020 Dated 22.05.2023
E-2	Thiru.T.R.Varadha Rajan 1, Ramasamy Navakkar Street, Aruppukottai		48/12,48/13,48/14,50/ 2,50/3 (P) 50/4,50/5,50/6,50/11	2.22.50 Ha	KV1/737/2018 12.05.2022
E-3	Thiru. K.Bharathiraja S/o, Krishnan 78/M-33, Ajeesh Nagar, Thenvalad Street, Aruppukottai Town and Taluk		26/6A,26/6B,26/C,26/ 7,26/2A	0.80.50Ha	KV1/537/2019 Dated: 16.11.2021
E-4	Tmt.T.Muthulakshmi w/o Tamilselven 65/12/338, Kamaraj Nagar 2 nd Street, Paramakudy Ramanadhapuram District		100/6B,100/7,100/8,1 00/9,100/10,100/11	1.96.00 Ha	KV1/75/2021 Dated 13.04.2023
E-5	Thiru.K.Balamurugan		104/1A,104/1B1,104/ 1B2,104/2A,104/2B,1 04/3,104/4A1,104/4A 2,104/4B,104/4C,104/ 5A,104/5B,104/6A,10 4/6B,104/7A,104/7B, 104/8A,104/8B,104/8 C,104/8D,104/8E	3.02.50 Ha	KV1/030/2021 Dated 14.02.2025
E-6	Thiru.m.Thiruvappu S/o Muniasamy Devakurutchi Village Kadaladi Taluk, Ramanathapuram District		64/3A,64/3B,64/3D,6 5/2A,65/2B,65/3A,65/ 6,66/1A1,66/1A2,66/1 B2,66/2A2,66/2B1,66 /2B2,67/3A1,65/3B1, 66/3B2,67/3A1,65/3B 1,66/3B2,66/1B1,66/2 A1,64/1B1,66/2A1,64 /6A,64/7A,64/6B,64/7 B	3.40.50	KV1/666/2020 06.06.2023
TOTAL CLUSTER EXTENT				12.71.5 Ha	
ABANDONED / EXPIRED QUARRY					
EXP-1	Thiru.P.Tamilselvam S/o Ramar 8/126, Madurai, Rameshwaram Road, Paramakudi, Ramanathapuram Taluk		3/8,3/9,3/10,3/11,3/12 A,3/12b, 3/12c,3/12d, 4/2,4/3,4/4A,4/4b,4/5, 4/6	3.59.0 Ha	25VNR0402658
TOTAL EXTENT				3.59.0 Ha	
TOTAL CLUSTER EXTENT				16.30.5 Ha	

STANDARD OPERATING PROCEDURE FOR SUNDAKKOTTAI VILLAGE CLUSTER MANAGEMENT COMMITTEE**1. Maintenance of Haul Roads and Village Roads:**

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

2. Maintenance of Drilling Activities

- In this system dust gets suppressed close to its formation. Dust suppression become very effective and the work environment will be improved from the point of occupational comfort and health.
 - Due to dust free atmosphere, the life of engine, compressor etc., will be increased.
 - The life of drill bit will be increased.
 - The rate of penetration of drill will be increased.
 - Due to the dust free atmosphere visibility will be improved resulting in safer working conditions.
 - 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 through training and awareness.
- Regular medical check-up and proper training to personnel to create awareness about adverse noise level effects

3. Maintenance of Blasting Activities

- Establish time of blasting to suit the local conditions and water sprinkling on blasting face
- Avoid blasting i.e., when temperature inversion is likely to occur and strong wind blows towards residential areas
- Controlled blasting includes Adoption of suitable explosive charge and short delay detonators, adequate stemming of holes at collar zone and restricting blasting to a particular time of the day i.e., at the time lunch hours (1.00 PM to 2.00 PM), controlled charge per hole as well as charge per round of hole
- Before loading of material water will be sprayed on blasted material
- Dust mask will be provided to the workers and their use will be strictly monitored
- The blasting operations in the cluster quarries are carried out without deep hole drilling and blasting using delay detonators, which reduces the ground vibrations;
- Proper quantity of explosive, suitable stemming materials and appropriate delay system will be adopted to avoid overcharging and for safe blasting;
- Adequate safe distance from blasting will be maintained as per DGMS guidelines;
- Blasting shelter will be provided as per DGMS guidelines;
- Blasting operations will be carried out only during day time;
- The charge per delay will be minimized and preferably 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 such that the predicted peak particle velocity shall not exceed 8 Hz.
- Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices.

4. Maintenance of Greenbelt Activities

- Planting of trees all along main mine haul roads and regular grading of haul roads will be practiced to prevent the generation of dust due to movement of dumpers/trucks.
- Green belt of adequate width will be developed around the project areas.
- Suitable plan for conservation of Schedule-I Species have prepared and necessary fund for implement for the same will be made.
- 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.

5. Maintenance of Occupational Health

- Dust mask will be provided to the workers and their use will be strictly monitored.
- Annual medical checkups, trainings and campaigns will be arranged to ensure awareness about importance of wearing dust masks among all mine workers & tipper drivers.
- Ambient Air Quality Monitoring will be conducted six months once to assess effectiveness of mitigation measures proposed.
- Specific personnel training on work-site safety management will be taken up;
- Work site assessment will be done by rock scaling of each surface exposed to workers to prevent accidental rock falling and / or landslide, especially after blasting activities;
- Natural barriers, temporary railing, or specific danger signals will be provided along rock benches or other pit areas where work is performed at heights more than 2m from ground level;
- Maintenance of yards, roads and footpaths, providing sufficient water drainage and preventing slippery surfaces with an all-weather surface, such as coarse gravel will be taken up.

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

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.

6. Cluster Management Committee Policy

- 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 programme 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
- Monitoring of the water/ waste water quality, air quality and solid waste generated
- Analysis of the water and air samples collected through external laboratory
- Implementation and monitoring of the pollution control and protective measures/ devices which shall include financial estimation, ordering, installation of air pollution control equipment, waste water treatment plant, etc.
- Co-ordination of the environment related activities within the project as well as with outside agencies
- Collection of health statistics of the workers and population of the surrounding villages
- Green belt development
- Monitoring the progress of implementation of the environmental monitoring programme

Compliance to statutory provisions, norms of State Pollution Control Board, Ministry of Environment and Forests and the conditions of the environmental clearance as well as the consents to establish and consents to operate.

8.PROJECT BENEFITS

8.0 GENERAL

The Proposed Project for Quarrying Rough Stone and Gravel at Sundakkottai Village aims to produce 7,40,985m³ Rough Stone and Gravel 50,060m³ 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 34 persons for carrying out mining operations and give preference to the local people in providing employment in the three proposed quarries in the cluster. In addition, there will be opportunity for indirect employment to many people in the form of contractual jobs, business opportunities, service facilities etc. the economic status of the local people will be enhanced due to mining project.

8.2 SOCIO-ECONOMIC WELFARE MEASURES PROPOSED

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

8.3 IMPROVEMENT IN PHYSICAL INFRASTRUCTURE

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

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

8.4 IMPROVEMENT IN SOCIAL INFRASTRUCTURE

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

8.5 OTHER TANGIBLE BENEFITS

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

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

8.5.1 CORPORATE SOCIAL RESPONSIBILITY

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

CSR Cost Estimation

- CSR activities will be taken up in the Sundakkottai Village mainly contributing to education, health, training of women self-help groups and contribution to infrastructure etc., CSR budget is allocated as 2.5% of the profit.

8.5.2 CORPORATE ENVIRONMENT RESPONSIBILITY

For the proposed quarry 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.

Proponent intends to spent Rs 3,00,000/- towards CER for the Government School near the project site the details are given below:

TABLE 8.1 CER – ACTION PLAN

Activity	CER
• Renovation/ Construction of Existing Toilet • Providing Environmental Related books to the school Library • Carrying out plantation and maintenance in the school Ground • Any other requirements in consultation with the school Head master	Rs 3,00,000/-

9. ENVIRONMENTAL COST BENEFIT ANALYSIS

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

10.ENVIRONMENTAL MANAGEMENT PLAN – Thiru. R.Hariharasudhan

10.0. GENERAL

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

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

10.1. ENVIRONMENTAL POLICY

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

The Proponent Thiru. R.Hariharasudhan will –

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

Description of the Administration and Technical Setup –

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

The said team will be responsible for:

- Monitoring of the water/ waste water quality, air quality and solid waste generated
 - Analysis of the water and air samples collected through external laboratory
-

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

10.2. LAND ENVIRONMENT MANAGEMENT –

Landscape of the area will be changed due to the quarrying operation, restoration of the land by converting the quarry pit into temporary reservoir and the remaining part of the area (un utilized areas, infrastructure, haul Roads) will be utilized for greenbelt development. There is no major vegetation in the project area during the course of quarrying operation and after completion of the quarrying operation thick plantation will be developed under greenbelt development programme.

TABLE 10.1. PROPOSED CONTROLS FOR LAND ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

1.3. SOIL MANAGEMENT

There is no Waste anticipated during this plan period hence, disposal of waste does not arise. The overburden in the form of Gravel and Weathered rock are already removed during the previous lease period. The excavated rough stone (100%) will be directly loaded into Trucks to the needy customers.

TABLE 10.2. PROPOSED CONTROLS FOR SOIL MANAGEMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.4. WATER MANAGEMENT

In the proposed quarrying project, no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mine office. The quarrying operation is proposed up to a depth of 57m BGL, the water table in the area is 118m below ground level, hence the proposed projects will not intersect the Ground water table during entire quarry period.

TABLE 10.3. PROPOSED CONTROLS FOR WATER ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.5. AIR QUALITY MANAGEMENT

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

TABLE 10.4. PROPOSED CONTROLS FOR AIR ENVIRONMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.6. NOISE POLLUTION CONTROL

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

TABLE 10.5. PROPOSED CONTROLS FOR NOISE ENVIRONMENT

CONTROL	RESPONSIBILITY
Development of thick greenbelt all along the Buffer Zone (7.5 Meters) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn-out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager
Provision of earmuff/ ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager
Sharp drill bits are used to minimize noise from drilling	Mines Foreman

Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring is carried out in the project area and in surrounding villages to assess the impact due to the mining activities and the efficacy of the adopted noise control measures. Additional noise control measures will be adopted if required as per the observations during monitoring	Mines Manager
Reduce maximum instantaneous charge using delays while blasting	Mining Mate
Change the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination	Mines Manager
Undertake noise or vibration monitoring	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.7. GROUND VIBRATION AND FLY ROCK CONTROL

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

TABLE 10.6. PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK

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

Source: Proposed by FAE's & EIA Coordinator

10.8. BIOLOGICAL ENVIRONMENT MANAGEMENT

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

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.

- Greenbelt development all along the safety barrier of the project area

- It is also proposed to implement the greenbelt development programme and post plantation status will be regularly checked for every season.
- The main attributes that retard the survival of sapling is fugitive dust, this fugitive dust can be controlled by water sprinkling on the haul roads and installing a sprinkler unit near the newly planted area.
- Year wise greenbelt development will be recorded and monitored
 - Based on the area of plantation.
 - Period of plantation
 - Type of plantation
 - Spacing between the plants
 - Type of manuring and fertilizers and its periods
 - Lopping period, interval of watering
 - Survival rate
 - Density of plantation
- The ultimate reclamation planned leaves a congenial environment for development of flora & immigration of small fauna through green belt and water reservoir. The green belt and water reservoir developed within the Project at the end of mine life will attract the birds and animals towards the project area in the post mining period.

10.8.1. Green Belt Development Plan

About 1800nos. of saplings is proposed to be planted for the Mining plan period in safety barrier of applied mine lease area. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

The objectives of the greenbelt development plan are –

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

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

1.8.2. Species Recommended for Plantation

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

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

TABLE 10.7. RECOMMENDED SPECIES FOR THE PLANTATION

S.No	Botanical Name	Local Name
1	<i>Aegle marmelos</i>	Vilvamaram
2	<i>Albizia lebbek</i>	Vaagai maram
3	<i>Cassia fistula</i>	Konrai tree
4	<i>Lannea coromandelica</i>	Othiyam
5	<i>Limonia acidissima</i>	Vila maram
6	<i>Syzygium cumini</i>	Naval maram
7	<i>Toona ciliata</i>	Santhana Vembu
8	<i>Ficus hispida</i>	Aththimaram
9	<i>Borassus flabellifer</i>	Panai-maram

Source: Proposed by FAE's & EIA Coordinator

10.9. OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

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

10.9.1. Medical Surveillance and Examinations –

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

- General Physical Examination and Blood Pressure
- X-ray Chest and ECG
- Sputum test
- Detailed Routine Blood and Urine examination

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

TABLE 10.8. MEDICAL EXAMINATION SCHEDULE

Sl No	Activities	1 st Year	2 nd Year	3 rd Year	4 th Year	5 th 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)					

10.9.2 Proposed Occupational Health and Safety Measures –

- The mine site will have adequate drinking water supply so that workers do not get dehydrated.
- Lightweight and loose-fitting clothes having light colours will be preferred to wear.
- Noise exposure measurements will be taken to determine the need for noise control strategies.
- The personal protective equipment will be provided for mine workers.
- 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.
- In respect of contract work, safety code for contractors and workers will be implemented. They will be allowed to work under strict supervision of statutory person/officials only after they will impart training at vocational training centres. All personal protective equipment's will be provided to them.
- A safety committee meeting every month will be organized to discuss the safety of the mines and the persons employed.
- Celebration of annual mines safety week and environmental week in order to develop safety awareness and harmony amongst employees and co quarry owners.

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS**10.9.3: Health and Safety Training Programme**

The Proponent will provide special induction program along with machinery manufacturers for the operators and co-operators to run and maintain the machinery effectively and efficiently. The training program for the supervisors and office staffs will be arranged in the Group Vocational Training Centres in the State and engage Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner as per Metalliferous Mines Regulation, 1961.

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

Activities	Mitigation Measure	Provision for Implementation	Capital	Recurring per annum
Air Environment	Haul road maintenance & Water sprinkling	Lump sum fund allocation for daily maintenance of haul roads and thrice a day water sprinkling by fixed sprinklers or water tankers	0	50000
	Muffle blasting - To control fly rocks during blasting	Lump sum fund allocation Blasting face will be covered with sand bags / steel mesh / old tyres / used conveyor belts	0	5000
	Wet drilling procedure	Lump sum fund allocation for ensuring wet drilling by covering drill holes with wet gunny bags and spraying water while drilling	0	10000
	No overloading of trucks/trippers/tractors	Lump sum fund allocation Manual Monitoring through Security guard	0	5000
	Stone carrying trucks will be covered by tarpaulin	Lump sum fund allocation Manual Monitoring through Security guard	0	5000
	Enforcing speed limits of 20 km/hr within ML area	Lump sum fund allocation Manual Monitoring through Security guard	0	5000
	Regular monitoring of exhaust fumes as per RTO norms	Lump sum fund allocation Manual Monitoring through Security guard	0	5000
	Installing wheel wash system near gate of quarry	Installation + Maintenance + Supervision	50000	5000
	Source of noise will be during operation of transportation vehicles. HEMM for this proper maintenance will be done at regular intervals.	Provision made in Operating Cost	0	0
	Oiling & greasing of Transport vehicles and HEMM at regular interval will be done	Provision made in Operating Cost	0	0
Noise Environment	Adequate silencers will be provided in all the diesel engines of vehicles.	Provision made in Operating Cost	0	0
	It will be ensured that all transportation vehicles carry a fitness certificate.	Provision made in Operating Cost	0	0
	Safety tools and implements that are required will be kept adequately near blasting site at the time of charging.	Provision made in OHS part	0	0
	Line Drilling all along the boundary to reduce the PPV from blasting activity and implementing controlled blasting.	Provision made in Operating Cost	0	0
	Proper warning system before blasting will be adopted and clearance of the area before blasting will be ensured.	Blowing Whistle by Mining Mate / Blaster / Competent Person	0	0
	Provision for Portable blaster shed	Installation of Portable blasting shelter	50000	2000

	NONE! Blasting will be practiced to control Ground vibration and fly rocks	Rs. 30/- per 6 Tonnes of Blasted Material	0	0
Waste Management	Waste management (Spent Oil, Grease etc.,)	Provision for domestic waste collection and disposal through authorized agency	5000	20000
		Installation of dust bins	5000	2000
	Bio toilets will be made available outside mine lease on the land of owner itself	Provision made in Operating Cost	0	0
Mine Closure	1. Progressive Closure Activity - Surface Runoff management	Provision made in Operating Cost	0	0
	2. Progressive Closure Activity Barbed Wire Fencing to quarry area will be provisioned.	Provision made in Operating Cost	0	0
	3. Greenbelt development under safety zone during the mining period	Provision made in Operating Cost	0	0
	Size 6' X 5' with blue bog ground and white letters as mentioned in MoM Appendix II by the SEAC, TN	Fixed Display Board at the Quarry Entrance as permanent structure mentioning Environmental Conditions	10000	1000
Implementation of EC, Mining Plan & DGMS Condition	Air, Water, Noise and Soil Quality Sampling every 6 Months for Compliance Report of EC Conditions	Submission of 2 Half Yearly Compliance - Lab Monitoring Report as per CPCB norms	0	100000
	Workers will be provided with Personal Protective Equipment's	Lumpsum fund allocation	50000	15000
	Health checkup for workers will be provisioned	IME & PME Health checkup for all the employees will be covered batch wise.	0	50000
	First aid facility will be provided	Lumpsum fund allocation	0	5000
	Mine will have safety precaution signages, boards.	Provision for signages and boards made	10000	2000
	No parking will be provided on the transport routes. Separate provision will be made for vehicles (HEMMs). Flaggers will be deployed for traffic management	Lumpsum fund allocation	50000	10000
	Installation of CCTV cameras in the mines and mine entrance	Camera 4 Nos, DVR, Monitor with internet facility	30000	5000
	Appointment of Competent person for ensuring the safety operation	Provision made in operational cost	0	0

CER	As per MoEF & OC OM 22-65/2017-IA.III Dated 25.02.2021	Lumpsum fund allocation	3000000	0
TOTAL			5,60,000	3,02,000

Year Wise Break Up	
I Year	₹ 8,62,000/-
II Year	₹ 3,17,100/-
III Year	₹ 3,32,955/-
IV Year	₹ 3,49,603/-
V Year	₹ 3,67,083/-
Total	₹ 22.29 Lakhs

Cost inflation 5% per annum

Note: This Environmental Management plan cost will vary according to the public consultation comments

10.10 CONCLUSION –

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

11. SUMMARY AND CONCLUSION

The Draft EIA & EMP report prepared for the proposed Rough Stone and Gravel Quarry project located in S.F.Nos. 3/8, 3/9, 3/10, 3/11, 3/12A, 3/12B, 3/12C, 3/12D, 4/2, 4/3, 4/4A, 4/4B, 4/5 and 4/6 of Sundakkottai Village, Aruppukkottai Taluk, Virudhunagar District, Tamil Nadu State belongs to Thiru.R.Hariharasudhan the Project falls in the Cluster category consist of 1 Proposed & 3 Existing Quarries falls under "B" category as per MoEF & CC Notification S.O. 3977 (E).

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

The proposed project is categorized under category "B1" Activity 1(a) (mining lease area in cluster situation) and will be considered at SEIAA – TN after conducting Public Hearing and Submission of EIA/EMP Report for Grant of Environmental Clearance. "Draft EIA report prepared on the basis of ToR issued for carrying out public hearing for the grant of Environmental Clearance from SEIAA, Tamil Nadu".

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

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the months October to December 2025 (Retreating Monsoon) for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suitable mitigation measures for likely adverse impacts due to the proposed project is suggested individually for the respective proposed project under Chapter 10.

The project proponent ensures to obtain necessary clearances and quarrying will be carried out as per rules and regulations. The Mining Activity will be carried out in a phased manner as per the approved mining plan after obtaining EC, CTO from TNPCB, execution of lease deed and obtaining DGMS Permission and working will be carried out under the supervision of Competent Persons employed. Overall, the EIA report has predicted that the project will comply with all environment standards and legislation after commencement of the project and operational stage mitigation measures are implemented.

Mining operations has positive impact on environment and socio economy such as landscape improvement, water as by-product, economy development and better public services, providing and supply of Rough Stone as per market demand. Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 34 people directly in the proposed projects and indirectly around 50 people.

As discussed, it is safe to say that the proposed quarries are not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits. Green belt development around the area will also be taken up as an effective pollution mitigate technique, as well as to serve as biological indicators for the pollutants released from the Thiru.R.Hariharasudhan Rough Stone and Gravel Quarry (Extent 3.59.0ha).

12. DISCLOSURE OF CONSULTANT

The Project Proponent's Thiru. R.Hariharasudhan have engaged M/s Geo Exploration and Mining Solutions, an Accredited Organization under Quality Council of India – National Accreditation Board for Education & Training, New Delhi, for carrying out the EIA Study as per the ToR Issued.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS

No 17, Advaita Ashram Road,

Alagapuram, Salem – 636 004

Tamil Nadu, India

Email: info@geoexploration@gmail.com

Web: www.gemssalem.com

Phone: 0427 2431989.

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

Sl.No.	Name of the expert	In house/ Empanelled	EIA Coordinator		FAE	
			Sector	Category	Sector	Category
1	Dr. M. Ifthikhar Ahmed	In-house	1 38	A B	WP GEO SC	A A A
2	Dr. P. Thangaraju	In-house	1	A	HG GEO	A A
3	Mr. N. Senthikumar	Empanelled	31 38	A B	AQ WP RH	A B A
4	Mr. J. R. Vikram Krishna	Empanelled	1 38	A B	SHW RH NV	A A A
5	Mr. A. Jagannathan	In-house	-	-	AP NV SHW	A A B
6	Mrs. Jisha parameswaran	In-house	-	-	SW	B
7	Mr. Govindasamy	In-house	-	-	WP	B
8	Mr. Panneer Selvam	In-house	-	-	EB	B
9	Mr. A. Alimuthu	In-house	-	-	LU	B
10	Dr. T. Sasikala	Empanelled	-	-	SE	B

Abbreviations	
EC	EIA Coordinator
AEC	Assistant EIA Coordinator
FAE	Functional Area Expert
FAA	Functional Area Associates
TM	Team Member
GEO	Geology
WP	Water pollution monitoring, prevention and control
AP	Air pollution monitoring, prevention and control
LV	Land Use
AQ	Atmosphere, air quality monitoring and prediction
EB	Ecology and bio-diversity
NV	Noise and vibration
SE	Soil contamination
HO	Hydrology, ground water and water conservation
SC	Soil conservation
RM	Risk assessment and hazard management
SHW	Solid and hazardous wastes
MSW	Municipal Solid Wastes
IHW	Industrial Solid Wastes
HW	Hazardous Wastes

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/EMP

Declaration by experts contributing to the EIA/EMP for Thiru.R.Hariharasudhan Rough Stone & Gravel Quarry over an Extent of 3.59.0ha in Sundakkottai Village, Aruppukkottai Taluk, Virudhunagar District, Tamil Nadu State. It is also certified that information furnished in the above EIA study are true and correct to the best of our knowledge.

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

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

Designation: **EIA Coordinator**

Date & Signature:

Dr. M. Ifthikhar Ahmed

Period of Involvement: **March 2025 to till date**

FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

Sl. No.	Functional Area	Involvement	Name of the Expert/s	Signature
1	AP	- Identification of different sources of air pollution due to the proposed mine activity - Prediction of air pollution and propose mitigation measures / control measures	Mr. A. Jagannathan	<i>A. Jagannathan</i>
2	WP	- Suggesting water treatment systems, drainage facilities - Evaluating probable impacts of effluent/waste water discharges into the receiving environment/water bodies and suggesting control measures.	Dr. M. Ifthikhar Ahmed	<i>Dr. M. Ifthikhar Ahmed</i>
3	HG	- Interpretation of ground water table and predict impact and propose mitigation measures. - Analysis and description of aquifer Characteristics	Dr. P. Thangaraju	<i>P. Thangaraju</i>
4	GEO	- Field Survey for assessing the regional and local geology of the area. - Preparation of mineral and geological maps. - Geology and Geo morphological analysis/description and Stratigraphy/Lithology.	Dr. P. Thangaraju	<i>P. Thangaraju</i>
5	SE	- Revision in secondary data as per Census of India, 2011. - Impact Assessment & Preventive Management Plan - Corporate Environment Responsibility.	Dr. T. Sasikala	<i>T. Sasikala</i>
6	EB	- Collection of Baseline data of Flora and Fauna. - Identification of species labelled as Rare, Endangered and threatened as per IUCN list. - Impact of the project on flora and fauna. - Suggesting species for greenbelt development.	Mr. Panneer Selvam	<i>P. Panneer Selvam</i>
7	RH	- Identification of hazards and hazardous substances - Risks and consequences analysis - Vulnerability assessment - Preparation of Emergency Preparedness Plan - Management plan for safety.	Mr. J. R. Vikram Krishna	<i>J. R. Vikram Krishna</i>

8	LU	- Construction of Land use Map - Impact of project on surrounding land use - Suggesting post closure sustainable land use and mitigative measures.	Mr. A. Allimuthu	
9	NV	- Identify impacts due to noise and vibrations - Suggesting appropriate mitigation measures for EMP.	Mr. A. Jagannathan	
10	AQ	- Identifying different source of emissions and propose predictions of incremental GLC using AERMOD. - Recommending mitigations measures for EMP	Mr. N. Senthilkumar	
11	SC	Assessing the impact on soil environment and proposed mitigation measures for soil conservation	Dr. M. Iftikhar Ahmed	
12	SHW	- Identify source of generation of non-hazardous solid waste and hazardous waste. - Suggesting measures for minimization of generation of waste and how it can be reused or recycled.	Mr. J. R. Vikram Krishna	

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Iftikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above-mentioned Functional Area Experts and Team Members prepared this EIA/EMP for Rough Stone & Gravel Quarry Project over an Extent of 3.59.0ha in Sundakkottai Village, Aruppukkottai Taluk, Virudhunagar District, Tamil Nadu State. It is also certified that information furnished in the EIA study are true and correct to the best of our knowledge.

Signature & Date:



Name:

Dr. M. Iftikhar Ahmed

Designation:

Managing Partner

Name of the EIA Consultant Organization:

M/s. Geo Exploration and Mining Solutions

NABET Certificate No & Issue Date:

NABET/EIA/25-28/RA 0424 Dated: 25.08.2025

Validity:

Valid till 06.08.2028
