

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENT MANAGEMENT PLAN

FOR OBTAINING

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

“B1” CATEGORY (Cluster) – MINOR MINERAL – CLUSTER –

PATTA LAND - FRESH QUARRY

THIRU D. SHANMUGAM ROUGH STONE AND GRAVEL QUARRY

Cluster Extent – 9.06.5 Ha

(2 Proposed + 2 Existing Quarries)

Project Proponent

Thiru.D.SHANMUGAM,

S/o. D. Durai, No. 11, Kulakkarai Street,
Kilarungunam Village, Marakkanam Taluk,
Viluppuram District – 604 301

PROJECT LOCATION	PROPOSED PRODUCTION
S.F.No.27/4 and 27/5 Extent: 1.76.5 ha Nalmukkal Village, Marakkanam Taluk, Villuppuram District	Reserves: 1,51,259 m ³ of Rough stone & 24648 m ³ of Gravel Peak Production = 21,520m ³ of Rough Stone, 8826 m ³ of Gravel Proposed Depth = 25m bgl

ToR obtained vide

File No.11637 TOR Identification No. TO24B0108TN5849832N Dated: 03.03.2025

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/2225/RA 0276 Phone: 0427-2431989, Email: infogeoexploration@gmail.com Web: www.gemssalem.com	  Laboratory  EHS 360 LABS PRIVATE LIMITED, NABL Accredited laboratory 10/2 Ground floor, 50th street, 7th Avenue, Ashok Nagar, Chennai – 600 083.
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Baseline Monitoring Period

December 2024 to February 2025

APRIL 2025

UNDERTAKING

I D. Shanmugam given undertaking that this EIA & EMP report prepared for our Rough stone and Gravel quarry situated in S.F. No 27/4 and 27/5 over an extent of 1.76.5 Ha in Nalmukkal Village, Marakkanam Taluk and Villuppuram District based on the ToR issued by the State Level Environmental Impact Assessment Authority (SEIAA), Tamil Nadu vide Letter No File No.11637 TOR Identification No. TO24B0108TN5849832N Dated: 03.03.2025.

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



D.Shanmugam

Place : Viluppuram

Dated :

DECLARATION

I Dr. M.Ifthikhar Ahmed – EIA Co Ordinator declare that the EIA & EMP report for the Rough stone and Gravel quarry in S.F. No 27/4 and 27/5 over an extent of 1.76.5 Ha in Nalmukkal Village, Marakkanam Taluk and Viluppuram District 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.

PROPOSED QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
P1	Thiru.D.Shanmugam S/o. D. Durai, No. 11, Kulakkarai Street, Kilarungunam Village, Marakkanam Taluk, Viluppuram District – 604 301	Nalmukkal	27/4 & 27/5	1.76.5	File No.11637 TOR Identification No. TO24B0108TN5849832N Dated: 03.03.2025.
P2	Thiru.V.Nagarajan	Nalmukkal	34/1B1, 35/2B, 35/3, 35/4	4.75.0	Application in Process
TOTAL EXTENT				6.51.5	
EXISTING QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
E-1	Thiru.V.Ravichandran	Nalmukkal	26/1B1,27/3A & 27/3B	1.35.0	29.12.2022 to 28.12.2027
E-2	D.Durai	Nalmukkal	27/6, 27/7, 27/8	1.20.0	06.12.2022 to 05.12.2027
TOTAL EXTENT				2.55.0	
ABANDONED / EXPIRED QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
A-1	A.Sivananthan	Nalmukkal	28/3	1.64.0	-
A-2	V.Ravichandran	Nalmukkal	26/1A,26/1B1, 26/2A,27/3B,2 8/1B	3.17.5	-
A-3	V.Ravi	Nalmukkal	26/3	0.37.5	-
A-4	P.Gopi	Nalmukkal	26/4	0.98.0	-
TOTAL EXTENT				6.17.0	
TOTAL CLUSTER EXTENT				9.06.5 Ha	

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

TERMS OF REFERENCE (ToR) COMPLIANCE

Thiru.D.Shanmugam

File No.11637 TOR Identification No. TO24B0108TN5849832N Dated: 03.03.2025

SPECIFIC CONDITIONS- SEAC		
1	The PP shall furnish the details on no. of trees to be removed for the proposed quarrying activity and the compensatory planting proposed for the same in the EIA Report.	Noted & agreed.
2	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 required statutory personnel, appropriate environmental management, system of maintaining the haul roads and village/panchayat roads, authorized blasting operation, Monitoring system of the environmental & other statutory compliances & its reporting status, 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 Organisation chart of the Committee with defining the role of the members (iii) The 'Standard Operating Procedures' (SoP) executing the planned activities.	Noted and agreed PP has agreed to establish a Cluster Management Committee. Copy of the agreement concerning CMC will be Submitted during the appraisal meeting.
3	The PP shall erect DGPS reference pillars as per MCDR Rules, 1988 and furnish photographic evidences of the same at the time of EIA appraisal.	Noted and agreed PP has agreed to construct DGPS reference pillars in accordance with MCDR Rules. Relevant photographs will be provided during the SEAC presentation meeting.
4	The PP shall ensure that the CCTV Cameras are installed inside the mine premises and the photographs of the same shall be submitted at the time of EIA appraisal.	Noted and agreed. PP agreed to install CCTV cameras at the quarry site Photographs will be submitted during the appraisal meeting.
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 and agreed PP erected wire fencing around the quarry lease area and planted 900 indigenous tree species. Relevant photographs given in chapter II. Additionally, it was agreed to build garland drainage around the lease area.
6	Since the structures are situated within a radial distance of 500 m, the PP shall design the controlled blast parameters for reducing the blast-induced ground/air-vibrations and eliminating the fly rock from the blasting operations the PP shall submit the report accordingly during the EIA appraisal without any deviation.	Noted and agreed. PP has agreed to conduct a control blasting study aimed at minimizing ground vibrations and preventing fly rocks during blasting operations. The findings will be presented at the appraisal meeting.
7	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.
8	The PP shall prepare the EMP for the entire project life of mine, and also furnish the sworn affidavit stating to abide the EMP for the entire life of mine	Noted and agreed. PP has developed the Environmental Management Plan (EMP) for this proposal covering the entire lease duration of 10 years, and the affidavit will be included in the final Environmental Impact Assessment (EIA) and EMP report.

9	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 PP has agreed to carry out a study report on the combined environmental effects of both the existing and proposed quarries.
2.SEAC STANDARD CONDITIONS		
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.	Not applicable It is Fresh Lease.
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. Letter obtained from the VAO regarding surface features within 300m radius
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 and agreed The structure study has been carried out within the radius of 300m. There is no habitation within the radius of 300m from the project site the details of the structures is given in the EIA report, Chapter No.III
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 hydro-geological assessment was carried out to assess the potential effects on the groundwater table. It is expected that there will be no major impacts on the water bodies in the vicinity of the project site. Further information is given in Chapter 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, Tiger reserve etc., up to a radius of 25 km from the proposed site.	The Nearest Reserve Forest Kilsevar Reserve Forest 3.70km- NW
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.	Noted and agreed. It is a fresh quarry. The slope stability report will be submitted together with the half-yearly compliance report once the depth reaches 30 meters.

	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.	
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 a fresh quarry. The slope stability report will be submitted together with the half-yearly compliance report once the depth reaches 30 meters.
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 The Proponent given affidavit stating that the blasting operation will be carried out by the competent 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 The details of design for carrying out controlled blasting operation involving line drilling and muffle blasting to minimize blast-induced ground vibrations and controlled fly rock travel beyond 30 m from the blast site is detailed in Chapter 4.
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. The project proponent possesses no additional quarries except this proposal.
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,	It is a fresh lease
13	What was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines?	It is a fresh lease
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.	It is a fresh lease
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).	Noted and agreed The project site has been superimposed on the high resolution imagery. The Satellite imagery of the project site is enclosed in Chapter II Geomorphology map of the area is enclosed in Chapter II. Lithology and Geology Map of the area is enclosed in Chapter II.
16	The PP shall carry out Drone video survey covering the cluster, green belt, fencing, etc.,	Noted and agreed The Drone Video of the project site is taken covering the Greenbelt and Fencing around the Project site.
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 and agreed As per the recommendations during SEAC ToR Presentation of the proposal and commitment of PP a count of 900 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. As well the pp has provided wire fencing as recommended all along the boundary of the lease applied 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 mineral reserves and mineable reserves, planned production capacity, proposed working methodology justifications are provided in Chapter 2. The anticipated impacts of the mining operations on the surrounding environment and the remedial measures for the same are provided in Chapter 4.
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 The Organization chart indicating the appointment of various statutory officials and other competent persons to be appointed as per the provisions of Mines Act, 1952 and the MMR, 1961 for carrying out the quarrying operations scientifically and systematically in order to ensure safety and to protect the environment.
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 Winter season December 2024 to February 2025. The Details of the Baseline Monitoring is given in the Chapter No. 3.
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 Cumulative impact study has been carried out covering proposed and existing quarries in the cluster and results related to air pollution, water pollution, & health impacts have been given in chapter No. 7, Based on the results, environmental management plan has been prepared and given in Chapter No. 10.
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 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.
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.	Noted and Agreed 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. 3, Table No 3.3

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.
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 analyze 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.
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
30	A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific	Noted & agreed. Mine closure plan is detailed in 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 As per the recommendations during SEAC ToR Presentation of the proposal and commitment of PP a count of 900 Nos of trees were planted as a part of greenbelt development program all along the periphery of the lease applied area and approach roads and village roads.
33	Taller/one-year-old Saplings raised in appropriate size of bags, preferably eco-friendly bags should be planted as per the advice of local forest authorities/botanist/Horticulturist with regard to site 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 As per the recommendations during SEAC ToR Presentation of the proposal and commitment of PP a count of 900 Nos of trees were planted as a part of greenbelt development program all along the periphery of the lease applied area and approach roads and village roads.
34	A Disaster Management Plan shall be prepared and included in the EIA/EMP Report for the	Noted and agreed. Disaster management Plan is explicated in chapter 7.

	complete life of the proposed quarry (or) till the end of the lease period	
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. Risk Assessment and management Plan is explicated in chapter 7.
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 of the project elaborately discussed in chapter 10.
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. The anticipated impact and effective mitigation measures are discussed in the Chapter No. 4
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 Socio-economic studies were conducted within a 5-kilometer radius of the quarry site. Details of report given in Chapter 3.
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.	No Litigation is pending against this 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 details of the Project benefits are given in the Chapter No. 8.
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 previous EC with the site photographs which shall duly be certified by MoEF&CC, Regional Office, Chennai (or) the concerned DEE/TNPCB.	Noted and agreed.
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 The EMP has been prepared for the entire life of the mine i.e., up to the lease period.
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 CONDITIONS		
Cluster Management Committee		
1	Cluster Management Committee shall be framed which must include all the proponents in the cluster as members including the existing as well as proposed quarry.	Noted and agreed The Cluster management committee has been formed covering the existing and proposed quarries in the cluster
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 The information will be shared to the cluster management committee during the monthly meeting.
3	The List of members of the committee formed shall be submitted to AD/Mines before the execution of mining	Noted and agreed

	lease and the same shall be updated every year to the AD/Mines.	The list of members of the committee formed will be submitted to AD/Mines before resuming the mining operation.
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.	Noted and agreed It is an existing Granite quarry the blasting will be used occasionally for the removal of overburden only the blasting frequency and usage of haul roads are discussed.
5	The committee shall deliberate on risk & emergency management plan, fire safety & evacuation plan and sustainable development goals 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.	Noted and agreed The risk management plan and disaster management plan has been prepared and enclosed in this EIA report, Chapter No. 7.
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 Environmental policy of the cluster management committee is detailed in the EIA Report Chapter No. 6
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 The Restoration strategy is discussed in the progressive mine closure plan and enclosed in the Scheme of Mining plan.
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 The information on the health of the workers and the local people will be updated periodically along with medical examination.
Agriculture & Agro-Biodiversity		
9	Impact on surrounding agricultural fields around the proposed mining Area.	As the proposed lease area is dominantly surrounded by mining land, barren land, and fallow land, the impact on the surrounding agricultural fields if present is considerably low. The Mining operation will be carried out to reduce the impact further to the level of negligence.
10	Impact on soil flora & vegetation around the project site.	The vegetation details have been provided in chapter III. 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 vegetation including no. of trees & shrubs within the proposed mining area and. If so, transplantation of such vegetation all along the boundary of the proposed mining area shall committed mentioned in EMP.	Noted and agreed There are no trees within the existing quarry site, and therefore, no proposal for tree felling or removal is anticipated during the quarrying operations.
12	The Environmental Impact Assessment should study the agro-biodiversity, agro-forestry, horticultural plantations, the natural ecosystem, the soil micro flora, fauna and soil seed banks and suggest measures to maintain the natural Ecosystem.	Noted and agreed The details of the soil analysis and the impacts are given in the Chapter No 3 & 4.
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	Noted and agreed The project area is situated centre part of the quarry lands. The proposed Rough Stone quarrying operation will employ the wet drilling method, which is expected to have negligible impacts on nearby agricultural lands.
Forests		
15	The project proponent shall detailed study on impact of mining on Reserve forests and free ranging wildlife	Noted and agreed. 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.	There is no forest/wildlife within 10km radius, chapter 3 details of Ecology and Biodiversity, and 4 endemic vulnerable and endangered indigenous flora and fauna.
17	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection	Details are discussed in the Chapter No.3
18	The Environmental Impact Assessment should study impact on protected areas, Reserve Forests, National Parks, Corridors and Wildlife pathways, near project site	Anticipated Environment Impact and Mitigation measures are detailed in Chapter No.4
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 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	There are 8 open wells and 7 bore wells within the radius of 1km from the project area, Hydrogeological study has been conducted by the resistivity method
20	Erosion Control measures	Details discussed in the chapter No.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
22	The project proponent shall study impact on fish habitats and the food WEB/ food chain in the water body and Reservoir	Food webs describe who eats whom in an ecological community. Made of interconnected food chains, food webs help us understand how changes to ecosystems — say, removing a top predator or adding nutrients — affect many different species, both directly and indirectly. Whereas in this proposed project is for quarrying of Rough Stone and Gravel and is on a hard batholith formation where no diversion of any water bodies is proposed of there is no intersection of ground water table anticipated.
23	The project proponent shall study and furnish the details on potential fragmentation impact on natural environment, by the activities.	Details are given in the Chapter No 4.
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.	Details in Chapter 4 impact of bio diversity.
25	The Terms of Reference should specifically study impact on soil health, soil erosion, the soil	Details of impact on soil environment is detailed in Chapter No.4

	physical, chemical components and microbial components	
26	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, lakes and farmer sites	Kilsevir R.F. 3.70km-NW There is, National Parks, Eco sensitive areas, Wild life sanctuaries within the radius of 10km. An ecological survey of the study area was conducted particularly with reference to the listing of species and assessment of the existing baseline ecological (terrestrial) condition in the study area. Ecological Environment is discussed under Chapter 3
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. c) Sediment geochemistry in the surface streams.	There are 8 open wells and 7 bore wells within the radius of 1km from the project area, Hydrogeological study has been conducted by the resistivity method
Energy		
28	The measures taken to control Noise, Air, Water, Dust Control and steps adopted to efficiently utilise the Energy shall be furnished.	Noted and agreed. Control measures of Noise, Air Water, Dust discussed in chapter 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	Noted and agreed. Details discussed in chapter 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 and agreed. Details are discussed in chapter 3.
31	Impact of mining on pollution leading to GHGs emissions and the impact of the same on the local livelihood.	A greenhouse gas (GHG) is a gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), and ozone (O ₃) Carbon dioxide (CO ₂): Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials. Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle. Methane (CH ₄): Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices, land use and by the decay of organic waste in municipal solid waste landfills. Nitrous oxide (N ₂ O): Nitrous oxide is emitted during agricultural, land use, and industrial activities; combustion of fossil fuels and solid waste; as well as during treatment of wastewater
Mine Closure Plan		

32	Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued.	Progressive Mine closure plan has been prepared considering the entire lease period in the mining plan and the same has been approved.
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 and the scope for achieving SDGs	Noted and agreed Detailed EMP discussed in chapter 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.	Noted and agreed. Detailed EMP discussed in chapter 10.
Risk Assessment		
35	To furnish risk assessment and management plan including anticipated vulnerabilities during operational and post operational phases of Mining.	Noted and agreed. Risk Assessment and management Plan explicated in chapter 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.	Noted and agreed. Disaster management Plan details given in Chapter-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.	Letter obtained from the VAO regarding surface features within 300m radius
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. It will be updated in final EIA/EMP report.
39	The project proponent shall study and furnish the possible pollution due to plastic and micro plastic on the environment. The ecological risks and impacts of plastic & micro plastics on aquatic environment and fresh water systems due to activities, contemplated during mining may be investigated and reported	Noted and agreed. Plastic waste management of the proposed project explicated in chapter 7.

Standard Terms of Reference for (Mining of minerals)		
S.No	Terms of Reference	Reply
1.1	An EIA-EMP Report shall be prepared for peak capacity (.....MTPA) operation in an ML/project area of.....ha based on the generic structure specified in Appendix III of the EIA Notification, 2006.	Peak Production – 21,520m ³ Depth – 25m bgl Mine Lease area – 1.76.5 Ha

1.2	An EIA-EMP Report would be prepared for peak capacity operation to cover the impacts and environment management plan for the project specific activities on the environment of the region, and the environmental quality encompassing air, water, land, biotic community, etc. through collection of data and information, generation of data on impacts including prediction modeling for.... MTPA of mineral production based on approved project/Mining Plan for.... MTPA. Baseline data collection can be for any season (three months) except monsoon.	Peak capacity of 21,520m ³ operation to cover the impacts and environment management plan in chapter- IV and Chapter 10 covered in project specific activities. Baseline Data were collected for Post Monsoon Season Dec2024 – Feb 2025 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. III
1.3	Proper KML file with pin drop and coordinate of mine at 500-1000 m interval be provided.	Noted, Google earth image showing lease area with Coordinates of pillars in chapter-II.
1.4	A Study area map of the core zone (project area) and 10 km area of the buffer zone (1: 50,000 scale) clearly delineating the major topographical features such as the land use, surface drainage pattern including rivers/streams/nullahs/canals, locations of human habitations, major constructions including railways, roads, pipelines, major industries, mines, and other polluting sources. In case of ecologically sensitive areas such as Biosphere Reserves/National Parks/WL Sanctuaries/ Elephant Reserves, forests (Reserved/Protected), migratory corridors of fauna, and areas where endangered fauna and plants of medicinal and economic importance found in the 15 km study area should be given. The above details to be furnished in tabular form also.	Land use and land cover of the 10km Radius of study area is discussed in Chapter No. III. Geology map of the project area covering 10km radius Figure No. 2.8. page No.22 Geomorphology of the area is given in Chapter No 2 Figure No 2.9, page no.23 There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
1.5	Map showing the core zone delineating the agricultural land (irrigated and un-irrigated, uncultivable land as defined in the revenue records, forest areas (as per records), along with other physical features such as water bodies, etc should be furnished.	Land use and land cover of the study area is discussed in Chapter No. III with Physical features such as waterbodies, odai, canal etc.,
1.6	A contour map showing the area drainage of the core zone and 25 km of the study area (where the water courses of the core zone ultimately join the major rivers/streams outside the lease/project area) should also be clearly indicated in the separate map.	DEM data using Drainage pattern around 10km radius showing streams and lakes etc., discussed in Chapter No. 3.
1.7	Catchment area with its drainage map of 25 km area within and outside the mine shall be provided with names, details of rivers/ riverlet system and its respective order. The map should clearly indicate drainage pattern of the catchment area with basin of major rivers. Diversion of drains/ river need elaboration in form of length, quantity and quality of water to be diverted.	Drainage pattern around 10km radius showing streams and lakes etc., is discussed in Chapter No. 3.

1.8	(Details of mineral reserves, geological status of the study area and the seams to be worked, ultimate working depth and progressive stage-wise working scheme until the end of mine life should be provided on the basis of the approved rated capacity and calendar plans of production from the approved Mining Plan. Geological maps and sections should be included. The Progressive mine development and Conceptual Final Mine Closure Plan should also be shown in figures. Details of mine plan and mine closure plan approval of Competent Authority should be furnished for green field and expansion projects.	Details in chapter-2 showing the land features. And also enclosed Approved 3rd Scheme of mining plan in annexure.
1.9	Details of mining methods, technology, equipment to be used, etc., rationale for selection of specified technology and equipment proposed to be used vis-à-vis the potential impacts should be provided.	It is an opencast quarrying operation proposed to operate in Mechanized method. The height and width of the bench will be maintained as 5m with 90⁰ 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.
1.10	Impact of mining on hydrology, modification of natural drainage, diversion and channeling of the existing rivers/water courses flowing through the ML and adjoining the lease/project and the impact on the existing users and impacts of mining operations thereon.	Impact Studies and Mitigation Measures of Water Environment including Surface Water and Ground Water are discussed in Chapter 4.
1.11	A detailed Site plan of the mine showing the proposed break-up of the land for mining operations such as the quarry area, OB dumps, green belt, safety zone, buildings, infrastructure, Stockyard, township/colony (within and adjacent to the ML), undisturbed area -if any, and landscape features such as existing roads, drains/natural water bodies to be left undisturbed along with any natural drainage adjoining the lease /project areas, and modification of thereof in terms of construction of embankments/bunds, proposed diversion/re-channeling of the water courses, etc., approach roads, major haul roads, etc should be indicated.	Not Applicable. The details of waste dump management are given in the Chapter No. 4

1.12	Original land use (agricultural land/forestland/grazing land/wasteland/water bodies) of the area should be provided as per the tables given below. Impacts of project, if any on the land use, in particular, agricultural land/forestland/grazing land/water bodies falling within the lease/project and acquired for mining operations should be analyzed. Extent of area under surface rights and under mining rights should be specified. Area under Surface Rights					Land use and land cover of the study area is discussed in Chapter No. 3. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.5.																															
						<table><tr><th>Description</th><th>Present area (Ha)</th><th>Area required during first five years (Ha)</th><th>Area at the end of the lease period (Ha)</th></tr><tr><td>Area Under Quarrying</td><td>Nil</td><td>1.26.20</td><td>1.26.20</td></tr><tr><td>Infrastructure</td><td>Nil</td><td>0.02.00</td><td>0.02.00</td></tr><tr><td>Roads</td><td>Nil</td><td>0.02.00</td><td>0.02.00</td></tr><tr><td>Green Belt</td><td>Nil</td><td>0.21.90</td><td>0.46.30</td></tr><tr><td>Unutilized Area</td><td>1.76.50</td><td>0.24.40</td><td>Nil</td></tr><tr><td>Grand Total</td><td>1.76.50</td><td>1.76.50</td><td>1.76.50</td></tr></table>				Description	Present area (Ha)	Area required during first five years (Ha)	Area at the end of the lease period (Ha)	Area Under Quarrying	Nil	1.26.20	1.26.20	Infrastructure	Nil	0.02.00	0.02.00	Roads	Nil	0.02.00	0.02.00	Green Belt	Nil	0.21.90	0.46.30	Unutilized Area	1.76.50	0.24.40	Nil	Grand Total	1.76.50	1.76.50	1.76.50
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	Total																																				

1.15	Map (1: 50, 000 scale) of the study area (core and buffer zone) showing the location of various sampling stations superimposed with location of habitats, other industries/mines, polluting sources, should be provided. The number and location of the sampling stations in both core and buffer zones should be selected on the basis of size of lease/project area, the proposed impacts in the downwind (air) / downstream (surface water)/groundwater regime (based on flow). One station should be in the upwind/upstream/non-impact/non-polluting area as a control station. The monitoring should be as per CPCB guidelines and parameters for water testing for both ground water and surface water as per ISI standards and CPCB classification wherever applicable. Observed values should be provided along with the specified standards.	Details in chapter-3 showing the various sampling stations As per CPCB guidelines.
1.16	For proper baseline air quality assessment, Wind rose pattern in the area should be reviewed and accordingly location of AAMSQ shall be planned by the collection of air quality data by adequate monitoring stations in the downwind areas. Monitoring location for collecting baseline data should cover overall the 10km buffer zone i.e., dispersed in 10 km buffer area. In case of expansion, the displayed data of CAAQMS and its comparison	Air Quality Modelling and wind rose pattern for prediction of incremental GLC's of pollutant was carried out using AERMOD view 13 Model. Details in Chapter No. 4.
1.17	A detailed traffic study along with presence of habitation in 100 mts distance from both side of road, the impact on the air quality with its proper measures and plan of action with timeline for widening of road. The project will increase the no. of vehicle along the road which will indirectly contribute to carbon emission so what will be the compensatory action plan should be clearly spell out in EIA/ EMP report.	Traffic density survey was carried out to analyses 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-II.
1.18	The socio-economic study to conducted with actual survey report and a comparative assessment to be provided from the census data should be provided in EIA/ EMP report also occupational status & economic status of the study area and what economically project will contribute should be clearly mention. The study should also include the status of infrastructural facilities and amenities present in the study area and a comparative assessment with census data to be provided and to link it with the initialization and quantification of need-based survey for CSR activities to be followed.	Detailed in chapter-3 socio-economic study with occupational status & economic status of the study area. The study should also include the status of infrastructural facilities and amenities present in the study area CSR are discussed under Chapter 8.
1.19	The Ecology and biodiversity study should also indicate the likely impact of change in forest area for surface infrastructural development or mining activity in relation to the climate change of that area and what will be the compensatory measure to be adopted by PP to minimize the impact of forest diversion.	Detailed Ecology and biodiversity study in chapter-3
1.20	Baseline data on the health of the population in the impact zone and measures for occupational health and safety of the personnel and manpower for the mine should be submitted.	Detailed in chapter-4 population in the impact zone and measures for occupational health and safety and proposed occupational health in chapter-X
1.21	Impact of proposed project/activity on hydrological regime of the area shall be assessed and report be submitted. Hydrological studies as per GEC 2015 guidelines to be prepared and submitted.	Noted and agreed

1.22	Impact of mining and water abstraction from the mine on the hydrogeology and groundwater regime within the core zone and 10 km buffer zone including long-term monitoring measures should be provided. Details of rainwater harvesting and measures for recharge of groundwater should be reflected in case there is a declining trend of groundwater availability and/or if the area falls within dark/grey zone.	The ground water table is at 50-55m below ground level. In this project, ultimate depth is 25m Bgl It is inferred the quarrying activities in the Cumulative EIA project (Quarry) will not intersect the Ground water table.
1.23	Study on land subsidence including modeling for prediction, mitigation/prevention of subsidence, continuous monitoring measures, and safety issues should be carried out.	Detailed in Chapter-IV Anticipated and mitigation measures of in the study area.
1.24	Detailed water balance should be provided. The breakup of water requirement as per different activities in the mining operations, including use of water for sand stowing should be given separately. Source of water for use in mine, sanction of the Competent Authority in the State Govt. and impacts vis-à-vis the competing users should be provided.	Total Water Requirement: 1.6 KLD Discussed under Chapter 2, Table No 2.15, The required water will be met from rainwater accumulated in mine pit (when available) and from the approved water vendors.
1.25	PP shall submit design details of all Air Pollution control equipment (APCEs) to be implemented as part of Environment Management Plan vis-à-vis reduction in concentration of emission for each APCEs	Methodology And Instrument Used for Air Quality Analysis in chapter-3 and Air Pollution control equipment (APCEs) in chapter-10 sub 10.2 Environmental policy.
1.26	PP shall propose to use LNG/CNG based mining machineries and trucks for mining operation and transportation of mineral. The measures adopted to conserve energy or use of renewable sources shall be explored.	Details in Machinery and equipment details in Chapter-2 Table No 2.16
1.27	PP to evaluate the green house emission gases from the mine operation/ washery plant and corresponding carbon absorption plan.	Noted and agreed
1.28	Site specific Impact assessment with its mitigation measures, Risk Assessment and Disaster Preparedness and Management Plan should be provided.	A Risk Assessment and Disaster Preparedness and management Plan Chapter- 7
1.29	Impact of choice of mining method, technology, selected use of machinery and impact on air quality, mineral transportation, handling & storage/stockyard, etc, Impact of blasting, noise and vibrations should be provided.	Detailed in Machinery and technology used Chapter-3 Table 3.17 – Methodology and Instrument Used for Air Quality Analysis Detailed study in chapter-4 Impact of choice of mining method and impact on air quality and blasting and noise and vibrations.
1.30	Impacts of mineral transportation within the mining area and outside the lease/project along with flow-chart indicating the specific areas generating fugitive emissions should be provided. Impacts of transportation, handling, transfer of mineral and waste on air quality, generation of effluents from workshop etc, management plan for maintenance of HEMM and other machinery/equipment should be given. Details of various facilities such as rest areas and canteen for workers and effluents/pollution load emanating from these activities should also be provided.	Traffic density survey was carried out to analyses the impact of Transportation in the study area as per IRC guidelines 1961 and it is inferred that there is no much significant impact due to the proposed transportation from the project area. Details in Chapter 2. 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.
1.31	Details of various facilities to be provided to the workers in terms of parking, rest areas and canteen, and effluents/pollution load resulting from these activities should also be given.	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

1.32	The number and efficiency of mobile/static water jet, Fog cannon sprinkling system along the main mineral transportation road inside the mine, approach roads to the mine/stockyard/siding, and also the frequency of their use in impacting air quality should be provided.	Detailed in chapter-2 for mineral transportation route with approach roads etc., and impacting air quality detailed given chapter-4
1.33	Conceptual Final Mine Closure Plan and post mining land use and restoration of land/habitat to the pre- mining status should be provided. A Plan for the ecological restoration of the mined-out area and post mining land use should be prepared with detailed cost provisions. Impact and management of wastes and issues of re-handling (wherever applicable) and backfilling and progressive mine closure and reclamation should be furnished.	Discussed under Chapter 2. Mine Closure Plan is a part of Approved Mining Plan enclosed as Annexure Volume – 1.
1.34	Adequate greenbelt nearby areas, mineral stock yard and transportation area of mineral shall be provided with details of species selected and survival rate Greenbelt development should be undertaken particularly around the transport route.	Greenbelt Development Plan is discussed under Chapter 4
1.35	Cost of EMP (capital and recurring) should be included in the project cost and for progressive and final mine closure plan.	The total cost and the details are given in the Chapter No. 10
1.36	Details of R&R. Detailed project specific R&R Plan with data on the existing socio- economic status of the population (including tribals, SC/ST, BPL families) found in the study area and broad plan for resettlement of the displaced population, site for the resettlement colony, alternate livelihood concerns/employment for the displaced people, civic and housing amenities being offered, etc. and costs along with the schedule of the implementation of the R&R Plan should be given.	Not Applicable. There are no approved habitations within a radius of 300 meters. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
1.37	CSR Plan along with details of villages and specific budgetary provisions (capital and recurring) for specific activities over the life of the project should be given.	CSR are discussed under Chapter 8. And specific budgetary provisions (capital and recurring) for specific activities over the life of the project in chapter-10
1.38	Corporate Environment Responsibility:	CER are discussed under Chapter 8.
1.39	a) The Company must have a well laid down Environment Policy approved by the Board of Directors.	Detailed in chapter-10 The Environment Policy
1.40	b) The Environment Policy must prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.	
1.41	c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions must be furnished.	The Environment Monitoring Cell discussed under Chapter 6
1.42	d) To have proper checks and balances, the company should have a well laid down 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.	The Environment Monitoring Cell discussed under Chapter 6
1.43	e) Environment Management Cell and its responsibilities to be clearly spell out in EIA/ EMP report	The Environment Monitoring Cell discussed under Chapter 6
1.44	f) In built mechanism of self-monitoring of compliance of environmental regulations should be indicated.	The Environment Monitoring Cell discussed under Chapter 6
1.45	Status of any litigations/ court cases filed/pending on the project should be provided.	No litigation is pending in any court against this project

1.46	PP shall submit clarification from DFO that mine does not falls under corridors of any National Park and Wildlife Sanctuary with certified map showing distance of nearest sanctuary.	- Kazhuveli Birds Sanctuary – 13.26km- SE - Ossudu Lake Birds Sanctuary –27.31Km- South It will Submit final EIA/EMP report
1.47	Copy of clearances/approvals such as Forestry clearances, Mining Plan Approval, mine closer plan approval. NOC from Flood and Irrigation Dept. (if req.), etc. wherever applicable	Noted and agreed
1.48	Details on the Forest Clearance should be given as per the format given: Total Mine lease area (ha): Total Forest Land (Ha) : Date of FC : Extent of Forest Land : Balance area for which FC is yet to be obtained: Status of application for diversion of forest Land: If more than one provides details of each FC	Kilsevir R.F. 3.70km- NW Total Mine Lease area 1.76.5ha Details on the Forest Clearance will Submit final EIA/EMP report.
1.49	In case of expansion of the proposal, the status of the work done as per mining plan and approved mine closure plan shall be detailed in EIA/ EMP report.	Noted and agreed.
1.50	Details on Public Hearing should cover the information relating to notices issued in the newspaper, proceedings/minutes of Public Hearing, the points raised by the general public and commitments made by the proponent and the time bound action proposed with budgets in suitable time frame. These details should be presented in a tabular form. If the Public Hearing is in the regional language, an authenticated English Translation of the same. should be provided.	The outcome of public hearing will be updated in the final EIA/AMP report.
1.51	PP shall carry out survey through drone highlighting the ground reality for at least 10 minutes.	Noted and agreed
1.52	Detailed Chronology of the project starting from the first lease deed allotted/Block allotment/ Land acquired to its No. of renewals, CTO /CTE with details of no. renewals, previous EC(s) granted details and its compliance details, NOC details from various Govt bodies like Forest NOC(s), CGWA permissions, Power permissions, etc as per the requisites respectively to be furnished in tabular form.	Noted and agreed.
1.53	The first page of the EIA/ EMP report must mention the peak capacity production, area, detail of PP, Consultant (NABET accreditation) and Laboratory (NABL / MoEF & CC certification)	Noted and agreed. As per detailed in front page of Draft EIA/EMP, NABET, NABL certification detailed given in the report.
1.54	The compliances of Tor must be properly cited with respective chapter section and page no in tabular form and also mention sequence of the respective ToR complied within the EIA-EMP report in all the chapters section.	Noted and agreed. As per Tor compliance each chapter wise page and table, figure no given in the EIA/EMP report.

STANDARD TERMS OF REFERENCE		
1	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.	Not applicable. This is not a violation category project. This proposal falls under B1 Category
2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	The applied land for quarrying is a Patta Land. Document is enclosed along with Approved Mining Plan as Annexure Volume 1.
3	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	Noted & agreed.
4	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Map showing – Project area is with adjacent quarries details is enclosed in Figure No.1.1 Project area boundary coordinates superimposed on Toposheet – Figure No. 1.1A Toposheet of the project area covering 10km radius – Figure No. 1.2 Geology map of the project area covering 10km radius - Figure No. 2.11
5	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	Map showing – Geology map of the project area covering 10km radius - Figure No. 2.11 Geomorphological features are incorporated in the Toposheet map covering 10km radius around the project area Figure No. 2.12
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 10.1.
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, Table No 2.3
11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given	Not Applicable. There is no waste anticipated during this quarry operation. The entire quarried out rough stone will be transported to the needy customers. No Dumps is proposed outside the lease area.
12	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	Not Applicable. There is no Forest Land involved in the proposed project area. The proposed project area is a Patta land. Approved Mining Plan is enclosed as Annexure Volume 1.
13	Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	Not Applicable. The proposed project area does not involve any Forest Land.
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	Not Applicable. The project doesn't attract Recognition of Forest Rights Act, 2006.
15	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	No Reserve Forest within the Study Area.
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed 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	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.

	clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished	
18	A detailed biological study of the study area [core zone and buffer zone (10 KM radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	Detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] was carried out and discussed under Chapter No. 3. There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area.
19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravalli Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range'.
20	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	Not Applicable. The project doesn't attract The C. R. Z. Notification, 2018.
21	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	Not Applicable. There are no approved habitations within a radius of 300 meters. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
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	Baseline Data were collected for Winter Season (Dec 2024-Feb 2025) as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.

	meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	
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 Model. Details in Chapter No. 4,
24	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total Water Requirement for this project is given in the chapter No 2, Table No 2.13.
25	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Water for dust suppression, greenbelt development and domestic use will be obtained from accumulated rainwater/seepage water in mine pits. Drinking water will be sourced from the approved water vendors, No 2, Table No 2.13.
26	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	The rain water collected in the pits after spell of rain will be used for greenbelt development and dust suppression.
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 Quality discussed in Chapter No. 4.
28	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect 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.	The ground water table is at 50-55m below ground level. The ultimate depth of this projects is 25m from the general ground profile.
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.	Highest elevation of the project area is 72m AMSL Ultimate depth of the mine is 25m bgl Water level in the area is 50-55m BGL
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.	Progressive greenbelt development plan has been prepared and discussed along with Recommended Species details are given in the Chapter 4, Table No.4.9
31	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species	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

	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.	there is no much significant impact due to the proposed transportation from the project area. Details in Chapter 2.
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.	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. .
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Discussed in 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.	Details in Chapter 10.
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.	Details in Chapter 10.
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.	Details in Chapter 4,
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.	Environment Management Plan Chapter 10.
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.	The outcome of public hearing will be updated in the final EIA/EMP report
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	No litigation is pending in any court against this project.

	incorporated in the final EIA/EMP Report of the Project.	
40	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	The proposed capital cost for Environmental Monitoring Programme is Rs 76,000/- cost is Rs per annum. Details in Chapter 6 . Total EMP Cost for the ten years period is Rs.7,60,000/-
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.	Details in Chapter 10.
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	Encloses as separate volume
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 given properly.
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 mining plan
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-IA. II(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IA. II (I) Dated: 4th August, 2009 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-IA. II(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not applicable.

J	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Surface Plan – Figure No. 2.2. Geological Plan – Figure No 2.9. Working Plan – Figure No 2.9. Closure Plan – Figure No.2.10.
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TABLE OF CONTENTS

1. INTRODUCTION.....	1
1.0 PREAMBLE.....	1
Source: ToR Letters of the respective project proponent.....	1
1.1 PURPOSE OF THE REPORT.....	1
1.1 IDENTIFICATION OF PROJECT AND PROJECT PROPONENTS	3
1.2 BRIEF DESCRIPTION OF THE PROJECT	4
1.3 ENVIRONMENTAL CLEARANCE.....	5
1.4 TERMS OF REFERENCE (ToR).....	5
1.5 POST ENVIRONMENT CLEARANCE MONITORING.....	6
1.6 GENERIC STRUCTURE OF EIA DOCUMENT	6
1.7 THE SCOPE OF THE STUDY	6
2. PROJECT DESCRIPTION.....	8
2.0 TYPE OF THE PROJECT.....	8
2.1 NEED FOR THE PROJECT.....	8
2. LOCATION OF THE PROJECT	8
2.3 GEOLOGY.....	17
2.4 RESOURCES AND RESERVES	23
2.5 METHOD OF MINING	28
2.6 PROJECT DESCRIPTION.....	29
2.7 PROJECT REQUIREMENT	31
2.8 EMPLOYMENT REQUIREMENT:.....	32
2.9 PROPOSED SCHEDULE FOR APPROVAL AND IMPLEMENTATION.....	32
2.10 TECHNOLOGY AND PROCESS DESCRIPTION	33
3. DESCRIPTION OF ENVIRONMENT	34
3.0 GENERAL	34
3.1 STUDY AREA	34
3.2 STUDY PERIOD.....	34
3.3 STUDY METHODOLOGY.....	34
3.5 LAND ENVIRONMENT.....	35
3.6 WATER ENVIRONMENT.....	45
3.7 AIR ENVIRONMENT	56
3.8 NOISE ENVIRONMENT.....	66

3.5 Ecological Environment.....	71
3.6 Flora in Buffer Zone.....	73
3.7 Socio Economic Environment	82
4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES	91
4.0 GENERAL	91
4.1 LAND ENVIRONMENT:.....	91
4.2 WATER ENVIRONMENT.....	92
4.3 AIR ENVIRONMENT	93
4.4 NOISE ENVIRONMENT.....	99
4.6 SOCIO ECONOMIC	106
4.7 OCCUPATIONAL HEALTH AND SAFETY	106
4.8 MINE WASTE MANAGEMENT	107
4.9 MINE CLOSURE.....	107
5.0 DESCRIPTION OF EACH ALTERNATIVE.....	110
5.1 SUMMARY OF ADVERSE IMPACTS OF EACH ALTERNATIVE	110
5.2 ANALYSIS OF ALTERNATIVE SITE	110
5.3 MITIGATION MEASURES PROPOSED FOR EACH ALTERNATIVE.....	110
5.4 SELECTION OF ALTERNATIVE.....	110
6. ENVIRONMENTAL MONITORING PROGRAMME.....	111
6.0 GENERAL	111
6.1 METHODOLOGY OF MONITORING MECHANISM.....	111
6.2 IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES.....	112
6.3 MONITORING SCHEDULE AND FREQUENCY	113
6.4 BUDGETARY PROVISION FOR EMP.....	113
6.5 REPORTING SCHEDULES OF MONITORED DATA.....	114
7. ADDITIONAL STUDIES.....	115
7.0 GENERAL	115
7.1. PUBLIC CONSULTATION	115
7.2 RISK ASSESSMENT	115
7.3 DISASTER MANAGEMENT PLAN.....	117
7.4 SOCIAL IMPACT ASSESSMENT	120
7.5 PLASTIC WASTE MANAGEMENT PLAN.....	128
7.6 Cluster Management Committee.....	129
8.PROJECT BENEFITS	134
8.0 GENERAL	134

8.1	EMPLOYMENT POTENTIAL	134
8.2	SOCIO-ECONOMIC WELFARE MEASURES PROPOSED	134
8.3	IMPROVEMENT IN PHYSICAL INFRASTRUCTURE	134
8.4	IMPROVEMENT IN SOCIAL INFRASTRUCTURE	134
8.5	OTHER TANGIBLE BENEFITS	134
9.	ENVIRONMENTAL COST BENEFIT ANALYSIS	136
10.	ENVIRONMENTAL MANAGEMENT PLAN	137
10.0.	GENERAL	137
10.1.	ENVIRONMENTAL POLICY	137
10.2.	LAND ENVIRONMENT MANAGEMENT –.....	138
10.3.	SOIL MANAGEMENT.....	138
10.4.	WATER MANAGEMENT.....	139
10.5.	AIR QUALITY MANAGEMENT	139
10.6.	NOISE POLLUTION CONTROL	139
10.7.	GROUND VIBRATION AND FLY ROCK CONTROL.....	140
10.8.	BIOLOGICAL ENVIRONMENT MANAGEMENT	140
10.9.	OCCUPATIONAL SAFETY & HEALTH MANAGEMENT.....	142
10.10.:	CONCLUSION –.....	147
11.	SUMMARY AND CONCLUSION	148
12.	DISCLOSURE OF CONSULTANT	150

LIST OF TABLES

TABLE 1.1: ToR OBTAINED PROJECTS	1
TABLE 1.2: DETAILS OF PROJECT PROPONENT	3
TABLE 1.3: SALIENT FEATURES OF THE PROPOSED PROJECT	3
TABLE 1.4: ENVIRONMENT ATTRIBUTES	6
TABLE 2.2: CO-ORDINATES – PROJECT BOUNDARY	8
TABLE 2.3: LAND USE PATTERN	17
TABLE 2.4: RESOURCES AND RESERVES	17
TABLE 2.5: RESOURCES AND RESERVES	23
TABLE 2.6: YEAR-WISE PRODUCTION PLAN	23
TABLE 2.7: ULTIMATE PIT DIMENSION	25
TABLE 2.8 PROPOSED MACHINERY DEPLOYMENT	29
TABLE.2.9: TRAFFIC SURVEY LOCATIONS	29
TABLE 2.10: EXISTING TRAFFIC VOLUME.....	30
TABLE 2.11: ROUGH STONE & GRAVEL HOURLY TRANSPORTATION REQUIREMENT	30
TABLE 2.12: SUMMARY OF TRAFFIC VOLUME	30
TABLE 2.13: WATER REQUIREMENT FOR THE PROJECT	31
TABLE 2.14: PROPOSED MANPOWER DEPLOYMENT	32
TABLE 2.15: EXPECTED TIME SCHEDULE	32
TABLE 3.1: MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING	35
TABLE 3.2: LAND USE / LAND COVER TABLE 10 Km RADIUS.....	36
TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER	40
TABLE 3.4: NEARBY WATER BODIES FROM THE PROPOSED PROJECT SITE	40
TABLE 3.5: SOIL SAMPLING LOCATIONS.....	40
TABLE 3.6: METHODOLOGY OF SAMPLING COLLECTION	41
TABLE 3.7: SOIL QUALITY OF THE STUDY AREA	44
TABLE 3.8: WATER SAMPLING LOCATIONS	46
TABLE 3.9: GROUND WATER SAMPLING RESULTS.....	48
TABLE 3.10: SURFACE WATER SAMPLING RESULTS	49
TABLE 3.11: WINTER SEASON WATER LEVEL OF OPEN WELLS 1 KM RADIUS	51
TABLE 3.12: WINTER SEASON WATER LEVEL OF BOREWELLS 1 KM RADIUS	52

TABLE 3.13: RAINFALL DATA.....	57
TABLE 3.14: METEOROLOGICAL DATA RECORDED AT SITE	57
TABLE 3.15: METHODOLOGY AND INSTRUMENT USED FOR AAQ ANALYSIS	58
TABLE 3.16: NATIONAL AMBIENT AIR QUALITY STANDARDS	59
TABLE 3.17: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS	60
TABLE 3.18: SUMMARY OF AAQ 1 to AAQ 7	62
TABLE 3.19: ABSTRACT OF AMBIENT AIR QUALITY DATA	63
TABLE 3.20: DETAILS OF SURFACE NOISE MONITORING LOCATIONS	67
TABLE 3.21: AMBIENT NOISE QUALITY RESULT	69
Table 3.22: Flora in Core Zone.....	74
Table 3.23: Flora in Buffer Zone	75
Table 3.24: Methodology applied during survey of fauna	78
Table 3.25: Fauna in Core Zone	79
Table 3.26: Fauna in Buffer Zone.....	79
Table 3.27: Population Characteristics around 10km radius	84
Table 3.28: Occupational Characteristics around 10km radius	86
Table No 3.29 Structures details in the study area around 300m Radius.....	90
TABLE 4.1: ESTIMATED EMISSION RATE.....	94
TABLE 4.2: INCREMENTAL & RESULTANT GLC OF PM ₁₀	97
TABLE 4.3: INCREMENTAL & RESULTANT GLC OF PM _{2.5}	97
TABLE 4.4: INCREMENTAL & RESULTANT GLC OF SO ₂	97
TABLE 4.5: INCREMENTAL & RESULTANT GLC OF NO _x	98
TABLE 4.7: ACTIVITY AND NOISE LEVEL PRODUCED BY MACHINERY	100
TABLE 4.8: PREDICTED NOISE INCREMENTAL VALUES	100
TABLE 4.9: PREDICTED PPV VALUES DUE TO BLASTING	101
TABLE 4.12: RECOMMENDED SPECIES FOR GREENBELT DEVELOPMENT PLAN	105
TABLE 4.13: GREENBELT DEVELOPMENT PLAN	106
TABLE 6.1 IMPLEMENTATION SCHEDULE	112
TABLE 6.2: PROPOSED MONITORING SCHEDULE POST EC	113
TABLE 6.3 ENVIRONMENT MONITORING PROGRAM BUDGET	113
TABLE 7.1 RISK ASSESSMENT& CONTROL MEASURES	115

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION	118
TABLE 7.3: PROPOSED FIRE EXTINGUISHERS AT DIFFERENT LOCATIONS	119
TABLE 7.4: LIST OF QUARRIES WITHIN 500 METER RADIUS	120
TABLE 7.5: SALIENT FEATURES OF PROPOSAL “P1”	121
TABLE 7.7: SALIENT FEATURES OF PROPOSAL “E1”	122
TABLE 7.8: SALIENT FEATURES OF PROPOSAL “E2”	123
TABLE 7.11: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE	124
TABLE 7.12: CUMULATIVE PRODUCTION LOAD OF GRAVEL	124
TABLE 7.14: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS	125
TABLE 7.15: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER	125
TABLE 7.16: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER.....	126
TABLE 7.17: NEAREST HABITATION FROM EACH MINE.....	127
TABLE 7.18: GROUND VIBRATIONS AT 3 MINES.....	127
TABLE 7.19: SOCIO ECONOMIC BENEFITS FROM 3 MINES	127
TABLE 7.20: EMPLOYMENT BENEFITS FROM 3 MINES.....	128
TABLE 7.21: GREENBELT DEVELOPMENT BENEFITS FROM 3 MINES.....	128
TABLE 7.22: ACTION PLAN TO MANAGE PLASTIC WASTE	128
TABLE 8.1 CER – ACTION PLAN	135
TABLE 10.1. PROPOSED CONTROLS FOR LAND ENVIRONMENT	138
TABLE 10.2. PROPOSED CONTROLS FOR SOIL MANAGEMENT	138
TABLE 10.3. PROPOSED CONTROLS FOR WATER ENVIRONMENT	139
TABLE 10.4. PROPOSED CONTROLS FOR AIR ENVIRONMENT	139
TABLE 10.5.: PROPOSED CONTROLS FOR NOISE ENVIRONMENT	140
TABLE 10.6.: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK – P1	140
TABLE 10.7: PROPOSED GREENBELT ACTIVITIES.....	141
TABLE 10.8. RECOMMENDED SPECIES FOR THE PLANTS/ANIMALS	142
TABLE 10.9. MEDICAL EXAMINATION SCHEDULE	142
TABLE 10.10: EMP BUDGET FOR PROPOSED PROJECT	144

LIST OF FIGURES

FIGURE 1.1 SATELLITE IMAGERY CLUSTER QUARRIES	2
FIGURE 1.2 LOCATION MAP OF THE PROJECT SITE.....	5
FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS	3
FIGURE 1.4: TOPOSHEET MAP OF THE STUDY AREA 2KM RADIUS	4
FIGURE 2.1: TOPOGRAPHICAL VIEW OF PROJECT AREA.....	9
FIGURE 2.2: PHOTOGRAPHS OF FENCING & GREEN BELT	10
FIGURE 2.3: GOOGLE IMAGE OF THE PROJECT AREA	11
FIGURE 2.5: VILLAGE MAP SUPERIMPOSED ON GOOGLE EARTH IMAGE.....	13
FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS	14
FIGURE 2.7: IMAGE SHOWING SURFACE FEATURES AROUND 5 KM RADIUS	15
FIGURE 2.8: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS	16
FIGURE 2.9: REGIONAL GEOLOGY MAP.....	21
FIGURE 2.10: GEOMORPHOLOGY MAP.....	22
FIGURE 2.11: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS	24
FIGURE 2.12: CLOSURE PLAN AND SECTIONS.....	26
FIGURE 2.13: MINERAL TRANSPORTATION ROUTE MAP	30
FIGURE 3.1: PIE DIAGRAM OF LAND USE AND LAND COVER	36
FIGURE 3.2: PHYSIOGRAPHIC MAP 10KM RADIUS	38
FIGURE 3.3: LAND USE LAND COVER MAP 10KM RADIUS	39
FIGURE 3.4: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS	42
FIGURE 3.5: SOIL MAP	43
FIGURE 3.6: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS.....	47
FIGURE 3.7: OPEN WELL CONTOUR MAP Dec 2024- Feb 2025	51
FIGURE 3.8: BOREWELL CONTOUR MAP – Dec 2024 to Feb 2025	52
FIGURE 3.9: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE.....	53
FIGURE 3.10: GROUND WATER PROSPECT MAP	54
FIGURE 3.11: WINDROSE DIAGRAM.....	58
FIGURE 3.12: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS	61
FIGURE 3.13: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ7.....	64
FIGURE 3.14: BAR DIAGRAM OF PARTICULATE MATTER PM _{2.5}	64

FIGURE 3.15: BAR DIAGRAM OF PARTICULATE MATTER PM ₁₀	65
FIGURE 3.16: BAR DIAGRAM OF GASEOUS POLLUTANT SO ₂	65
FIGURE 3.17: BAR DIAGRAM OF GASEOUS POLLUTANT NO _x	66
FIGURE 3.18: NOISE MONITORING STATIONS AROUND 10 KM RADIUS	68
FIGURE 3.19: DAY TIME NOISE LEVELS IN CORE AND BUFFER ZONE	69
FIGURE 3.20: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE	70
Figure 3.21: Photographs of Flora in Core and Buffer Zone	77
Figure 3.22: Graphical Interpretation of Flora in Core and Buffer Zone.....	78
Figure 3.23: Graphical Interpretation of Fauna in Core and Buffer Zone	81
Figure 3.24: Photographs of Fauna in Core and Buffer Zone.....	81
Fig.3.25 Structure map around 300m Radius	89
FIGURE 4.1: AERMOD TERRAIN MAP.....	95
FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM ₁₀	95
FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF PM _{2.5}	95
FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NO _x	96
FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF SO ₂	96
FIGURE 4.6: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST	96
FIGURE 4.6: GROUND VIBRATION PREDICTION	101
FIGURE 6.1: PROPOSED ENVIRONMENTAL MONITORING CELL	112
FIGURE 7.1: DISASTER MANAGEMENT TEAM LAYOUT	117
FIGURE 10.1.: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS	143

1.INTRODUCTION

1.0 PREAMBLE

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

Rough Stone is the major requirements for construction industry. This EIA report is prepared by considering Cumulative load of the proposed for D.Shanmugam Rough Stone and Gravel Quarry, two proposed Quarries and two existing quarries with total extent of Cluster of 09.06.5 ha at Nalmukkal Village, Marakkanam Taluk, Villupuram District and Tamil Nadu State, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

This EIA Report is prepared in compliance with ToR obtained for the below proposals in Table 1.1 and the Baseline Monitoring study has been carried out during the period of Dec 2024 – Feb 2025

TABLE 1.1: ToR OBTAINED PROJECTS

Proponent Name	Extent (Ha)	Terms of Reference (ToR)
Thiru. D.Shanmugam	1.76.5	File No.11637. TOR Identification No. TO24B0108TN5849832N Dated:03.03.2025

Source: ToR Letters of the respective project proponent

1.1 PURPOSE OF THE REPORT

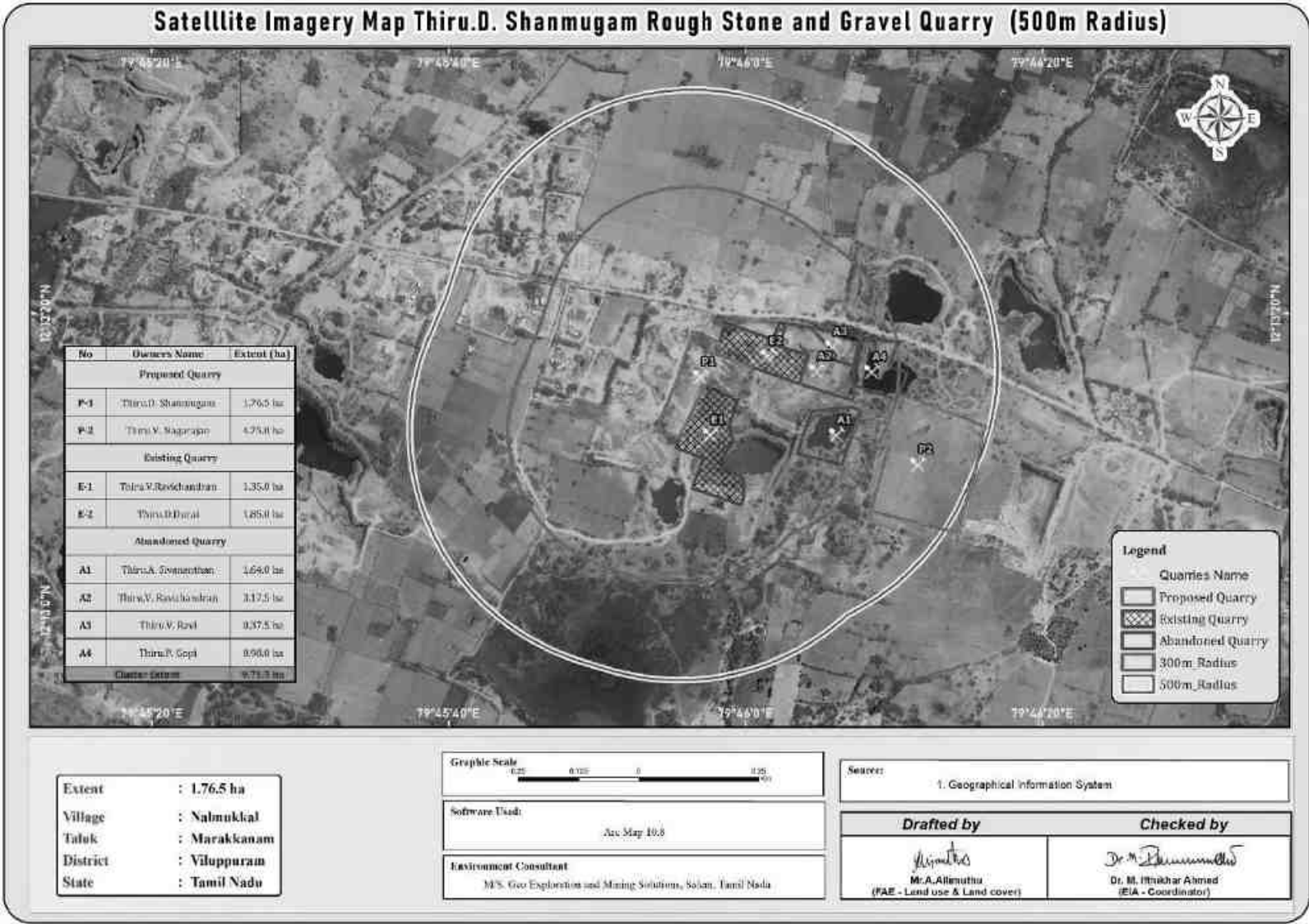
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14th September 2006 and its subsequent amendments as per Gazette Notification S.O. 1889 of 20th April 2022, Mining Projects are classified under two categories i.e. A (> 250 Ha) and B ($\leq$ 250 Ha), 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 projects are 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



1.1 IDENTIFICATION OF PROJECT AND PROJECT PROPONENTS

1.1.1 Identification of Project Proponent

TABLE 1.2: DETAILS OF PROJECT PROPONENT

Name of the Project Proponent	Thiru.D.Shanmugam Rough Stone and Gravel Quarry
Address	S/o. D. Durai, No. 11, Kulakkarai Street, Kilarungunam Village, Marakkanam Taluk, Viluppuram District – 604 301.
Mobile	+91 87542 22919
Email	Shanmugam.add@gmail.com
Status	Individual

1.1.2 Identification of Project

TABLE 1.3: SALIENT FEATURES OF THE PROPOSED PROJECT

Name of the Project	Thiru.D.Shanmugam Rough Stone and Gravel Quarry	
S.F. No.	27/4 & 27/5	
Extent	1.76.5 ha	
Village,Taluk and District	Nalmukkal Village, Marakkanam Taluk, Viluppuram District.	
Land Type	It is a patta land registered in the name of applicant Thiru.D.Shanmugam vide patta No.924	
Toposheet No	57 P/16	
Latitude between	12° 13' 11.6217"N to 12° 13' 18.8071"N	
Longitude between	79° 45' 53.7466"E to 79° 46' 00.2482"E	
Elevation of the area	72m AMSL	
Lease period	10 Years	
Mining Plan period	10 years	
Proposed Depth of Mining	25m bgl	
Geological Resources	Rough Stone in m ³	Gravel m ³
	6,17,750	35,300
Mineable Reserves	151259	24648
Year wise Production for 1 st five years	77478	24648
Year wise Production for 2 nd five years	73781	-
Peak Production	21520	8826
Ultimate Pit Dimension	XY-AB-52m (L) x 87m (W) x 20m(D) bgl XY-CD-66m (L) x 52m (W) x 25m(D) bgl X1Y1-AB-39m (L) x 112m (W) x 15m(D) bgl	
Water Level in the region	50-55 m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and Controlled blasting using Slurry Explosives	
Topography	The lease applied area is flat terrain. The area has gentle sloping towards North eastern side and altitude of the area is 72m above from Mean Sea level. The area is covered by 2m thickness of Gravel and followed by Massive Charnockite which is clearly inferred from the surface outcrops & nearby existing quarry pit.	
Machinery proposed	Hand Jack Hammer	3 Nos
	Compressor	1 No
	Excavator with Bucket and Rock Breaker	1 No
	Tippers	2 Nos

Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	21 Nos	
Project Cost	Rs. 58,33,000/-	
EMP Cost	Rs.7,60,000/-	
Total Project cost	Rs. 65,93,000/-	
CER Cost	Rs. 5,00,000/-	
Nearby Water Bodies	Nalmukkal Eri	250m South
	Odai	480m SW
	Kunnappakkam Lake	870m NE
	Budderi	880m NW
	Ariyanthangal Eri	1.3km SE
	Perumukkal Eri	2.3km SW
Greenbelt Development Plan	Proposed to plant 900 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	1.6 KLD	
Nearest Habitation	700m – South West	
Nearest Reserve Forest	Kilisevur R.F. – 3.70 km – North West (Source – DFO Letter)	
Nearest Wild Life Sanctuary	Oussudu Lake Birds Sanctuary -27.31km-South	

Source: Approved Mining & Land Documents.

1.2 BRIEF DESCRIPTION OF THE PROJECT

1.2.1 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 21520m³ maximum in a year (72m³ per day/ 6 Tippers per day considering 12m³ per load). The depth of the mining is 25m bgl.

1.2.2 Location of the Project

- The project site is located in Nalmukkal Village, Marakkanam Taluk and Viluppuram District.
- 43km Northeast of Viluppuram town, 19km Western side of Marakkanam Town and 1km Northern side of Nalmukkal Village.

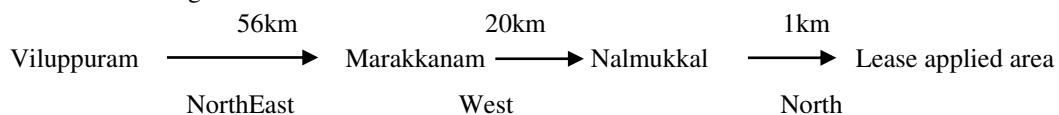
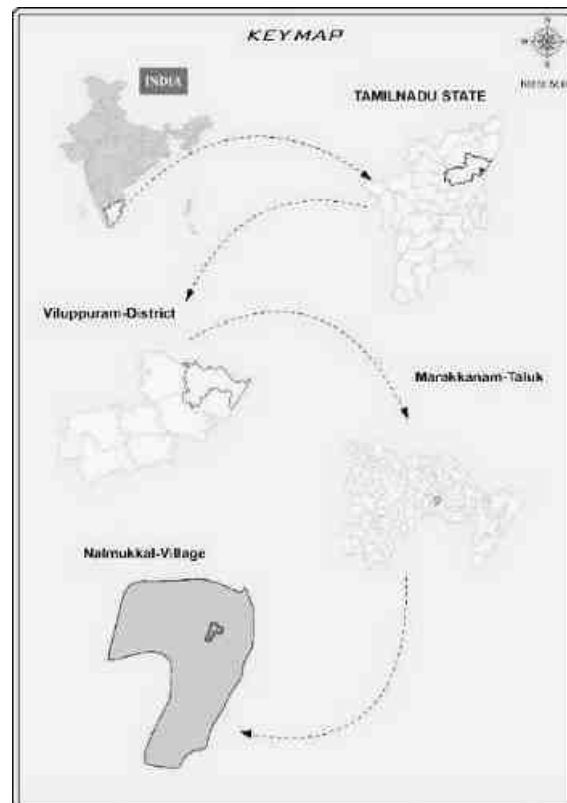


FIGURE 1.2 LOCATION MAP OF THE PROJECT SITE

Source: Survey of India Toposheet 58-A/15 & 16

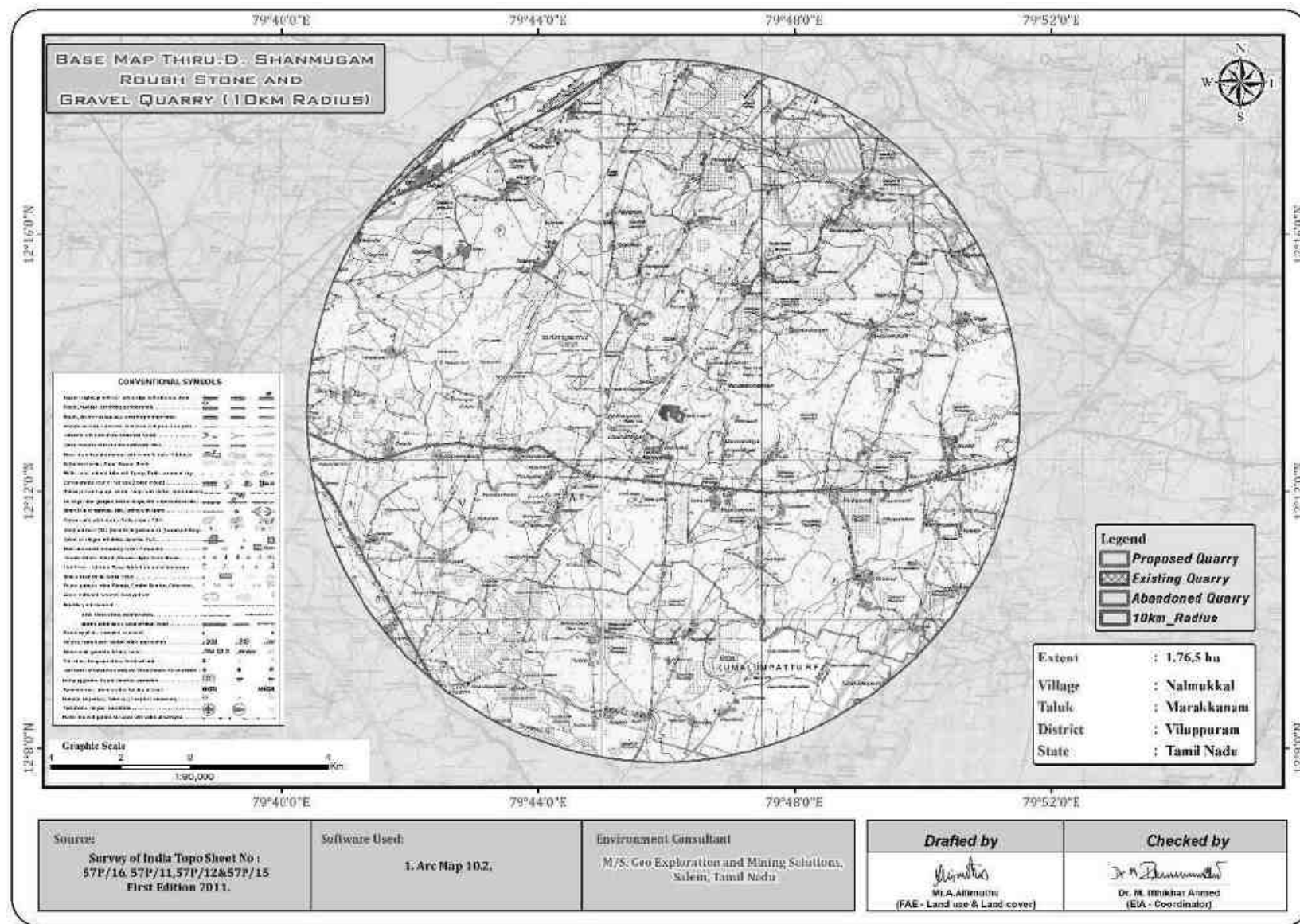
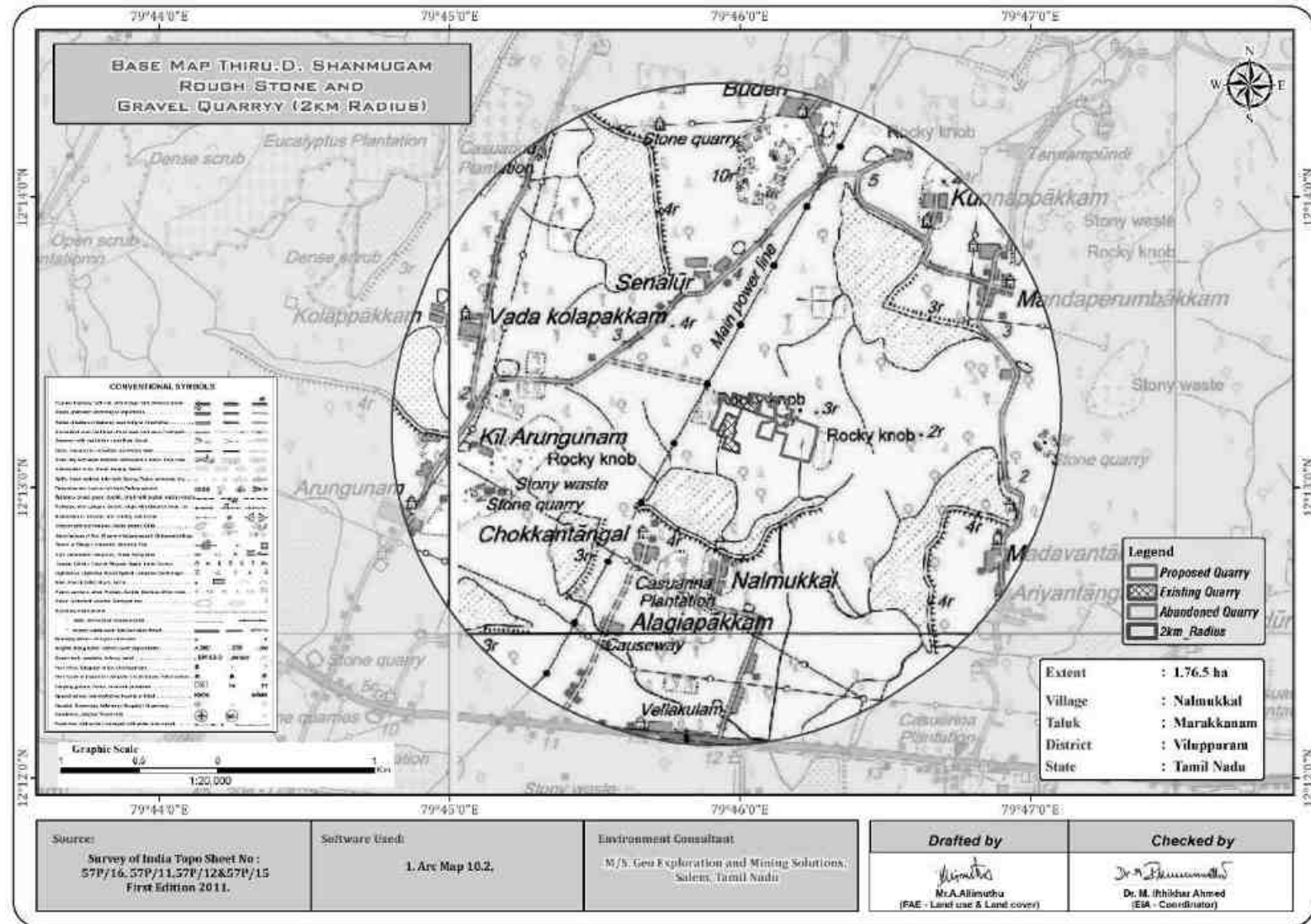
FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS

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

1.3 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 20.03.2024
- Precise area communication letter was issued by the Assistant Director vide Rc.No.B/G&M/134/2024, Dated: 07.08.2024.
- The Mining plan has been prepared by the Qualified person and got approval vide Letter Rc.No.B/G&M/134/2024 Dated: 14.08.2024.
- The proposed project falls under “B1” Category as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018
- Proponent applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/515556/2024 dated 24.12.2024

SCOPING:

- The proposal was placed in 532nd SEAC meeting held on 13.02.2025 and the committee recommended for issue of ToR.
- The proposal was considered in 798th Authority meeting held on 26.02.2025, issued ToR vide **File No.11637. TOR Identification No TO24B0108TN5849832N, dated: 03.03.2025**

PUBLIC CONSULTATION

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

APPRAISAL –

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

1.4 TERMS OF REFERENCE (ToR)

- The ToR was issued by the SEIAA vide **File No.11637. TOR Identification No TO24B0108TN5849832N, dated: 03.03.2025**

The Details of the ToR Compliance is given in the Page No. i to xxiv

1.5 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.

1.6 GENERIC STRUCTURE OF EIA DOCUMENT

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

1.7 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 Winter season (Dec 2024 to Feb 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 1.4: 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 (1 Core & 6 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

1.7.1 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
- ToR vide File No.11637 TOR Identification No. TO24B0108TN5849832N Dated: 03.03.2025

2. PROJECT DESCRIPTION

2.0 TYPE OF THE PROJECT

The Proposed Rough Stone Quarries requires Environmental Clearance. There are 2 proposed and 2 existing quarries forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is 09.06.5 ha.

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

2.1 NEED FOR 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 site is located in Nalmukkal Village, Marakkanam Taluk and Viluppuram District.
- 43km Northeast of Viluppuram town, 19km Western side of Marakkanam Town and 1km Northern side of Nalmukkal Village.

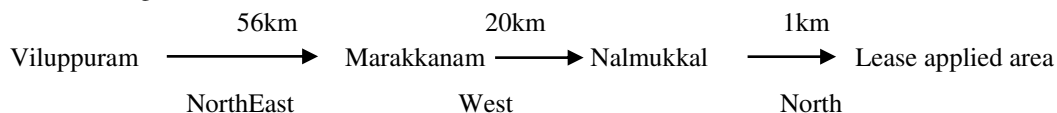


TABLE 2.1: SITE CONNECTIVITY

Nearest Roadway	NH - 32 – Puducherry to Chennai-9 km -NW SH – 134 – Thindivanam to Marakkanam-2km- South
Nearest Village	Nalmukkal – 1.43km- SE
Nearest Town	Thindivanam– 12.5.0km- West
Nearest Railway Station	Thindivanam– 12.5km-West
Nearest Airport	Puducherry– 28.5km – SE
Seaport	Chennai – 111.0km – NE

Source: Survey of India Toposheet

TABLE 2.2: CO-ORDINATES – PROJECT BOUNDARY

Corner Nos.	Latitude	Longitude
1	12°13'12.1212" N	79°45'53.7466" E
2	12°13'15.5277" N	79°45'55.1977" E
3	12°13'18.8071" N	79°45'56.2559" E
4	12°13'18.1092" N	79°45'58.0406" E
5	12°13'17.2813" N	79°45'57.8066" E

6	12°13'16.4168" N	79°46'00.2482" E
7	12°13'15.6391" N	79°45'59.9440" E
8	12°13'14.2121" N	79°45'59.3254" E
9	12°13'14.4888" N	79°45'58.7650" E
10	12°13'15.1170" N	79°45'57.1868" E
11	12°13'13.4580" N	79°45'56.2572" E
12	12°13'12.1588" N	79°45'55.5455" E
13	12°13'11.6217" N	79°45'55.3691" E
Datum: UTM-WGS84, Zone 43 North		

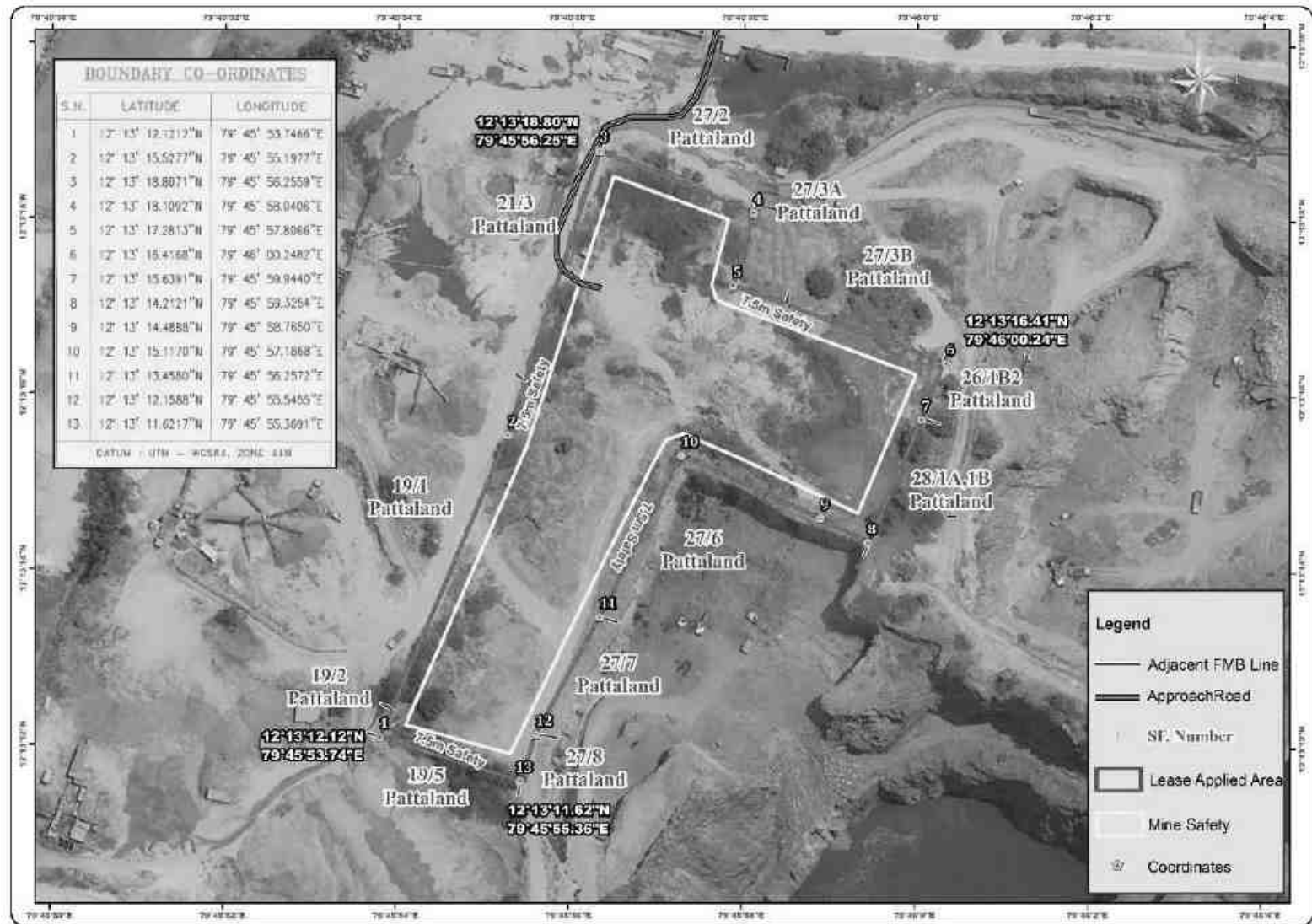
Source: Approved Mining Plan

FIGURE 2.1: TOPOGRAPHICAL VIEW OF PROJECT AREA





FIGURE 2.2: PHOTOGRAPHS OF FENCING & GREEN BELT

FIGURE 2.3: GOOGLE IMAGE OF THE PROJECT AREA

Source: Google Earth Imagery

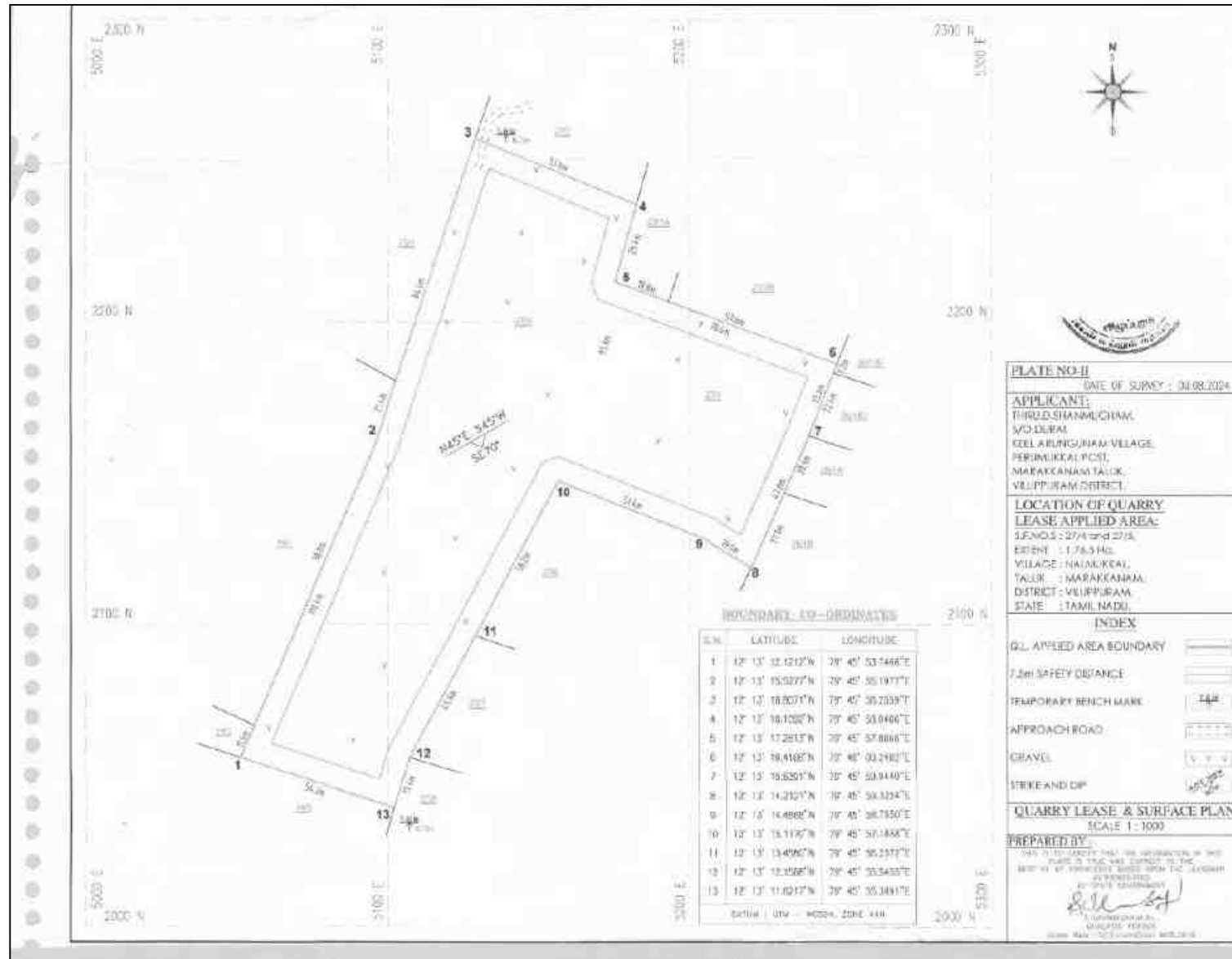
FIGURE 2.4: QUARRY LEASE PLAN / SURFACE PLANN

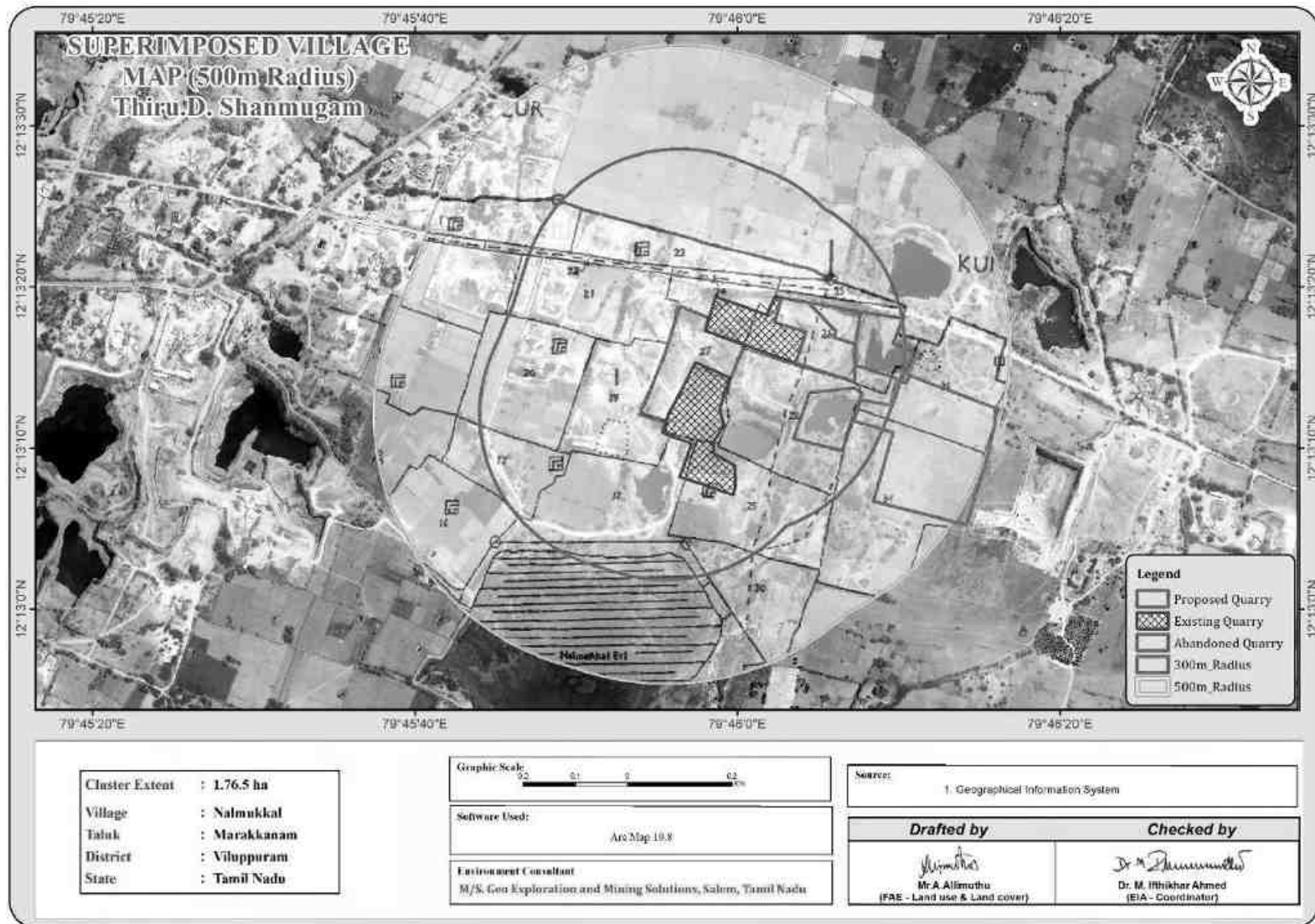
FIGURE 2.5: VILLAGE MAP SUPERIMPOSED ON GOOGLE EARTH IMAGE

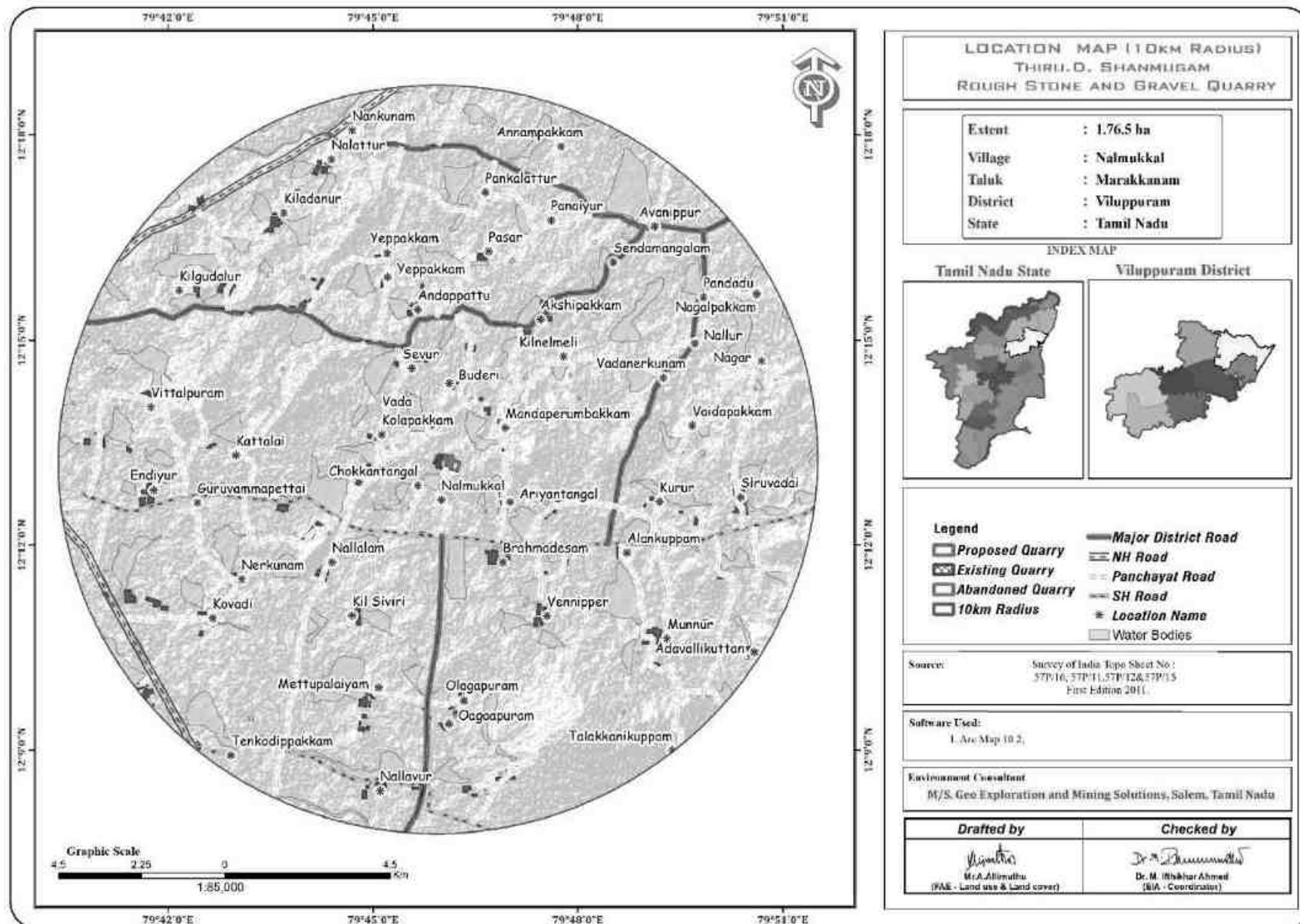
FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS

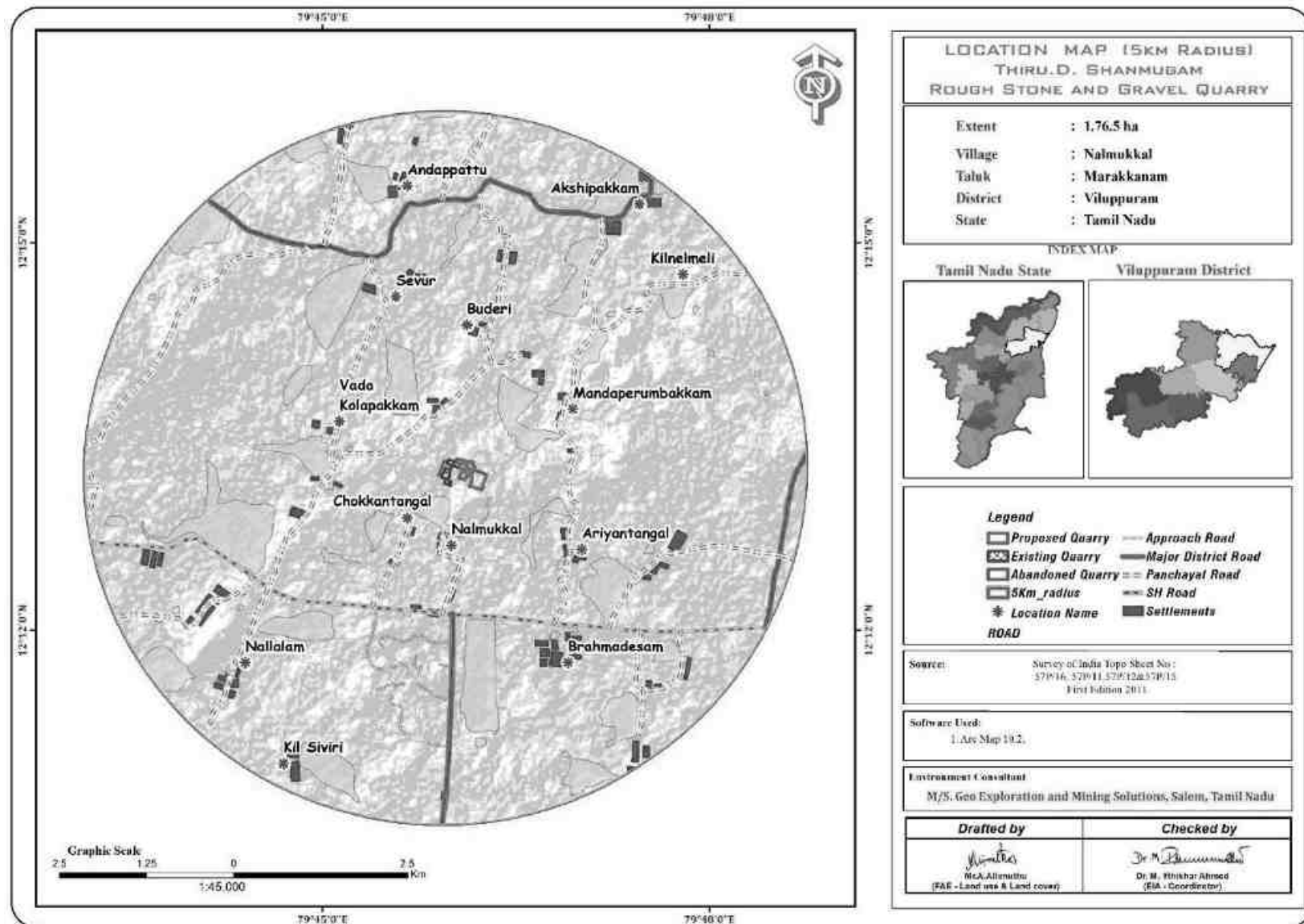
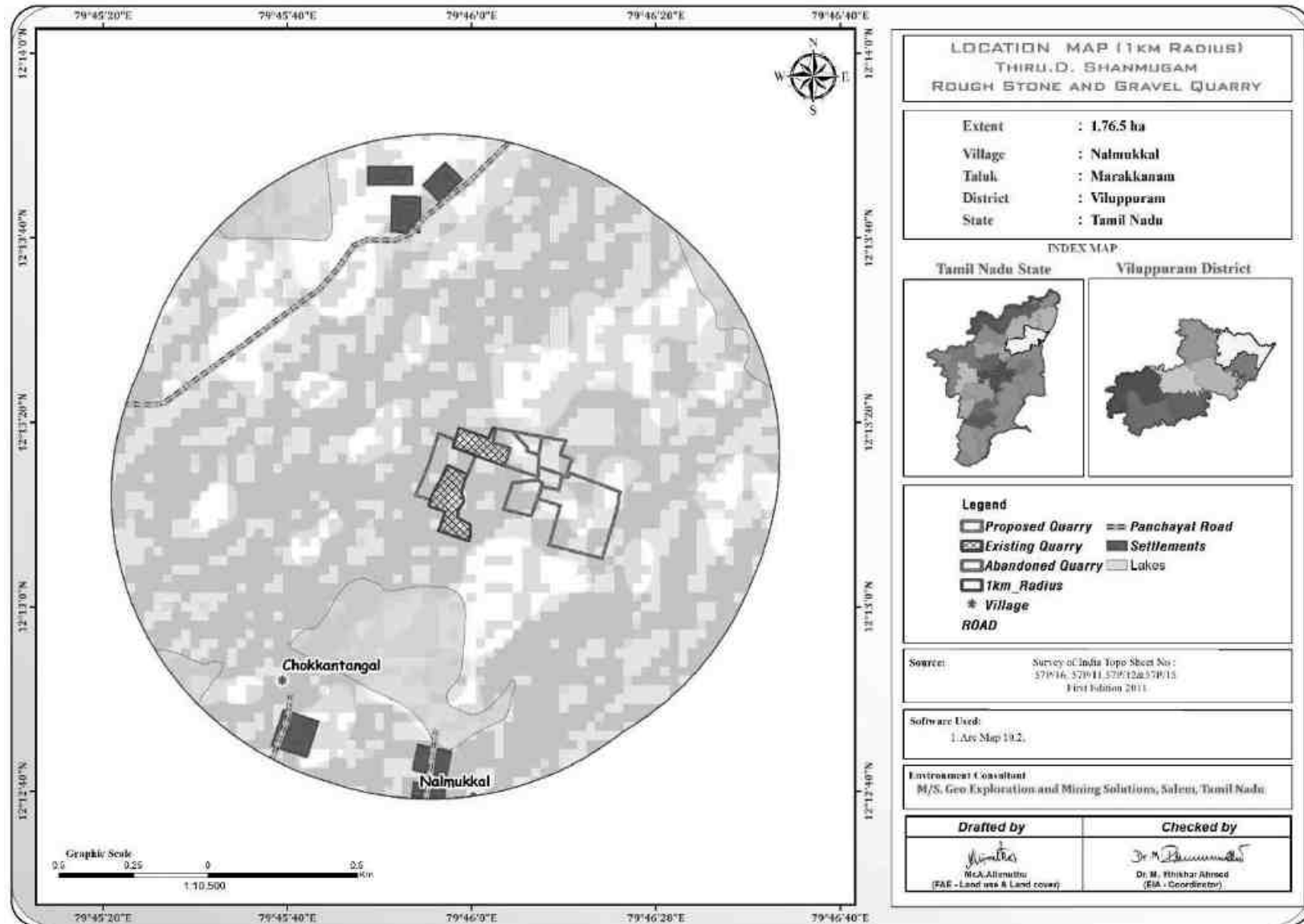
FIGURE 2.7: IMAGE SHOWING SURFACE FEATURES AROUND 5 KM RADIUS

FIGURE 2.8: 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 required during first five years (Ha)	Area at the end of the lease period (Ha)
Area Under Quarrying	Nil	1.26.20	1.26.20
Infrastructure	Nil	0.02.00	0.02.00
Roads	Nil	0.02.00	0.02.00
Green Belt	Nil	0.21.90	0.46.30
Unutilized Area	1.76.50	0.24.40	Nil
Grand Total	1.76.50	1.76.50	1.76.50

Source: Approved Mining

2.2.2 Size or Magnitude of Operation

TABLE 2.4: RESOURCES AND RESERVES

PARTICULARS	DETAILS	
	Rough Stone in m ³	Gravel in m ³
Geological Resources	617750	35300
Mineable Reserves	151259	24648
Production for 1 st five-year plan period	77478	24648
Production for 2 nd five-year plan period	73781	-
Peak Production	21520	8826
Mining Plan Period / Lease Applied Period	5 Years	
Number of Working Days	300 Days	
Production per day	50	27
No of Lorry loads (12m ³ per load)	4	2
Total Depth of Mining	25m below ground level.	

Source: Approved mining plan.

2.3 GEOLOGY

2.3.1 Regional Geology

Villupuram District is underlain by crystalline metamorphic complex in the western parts of district and sedimentary tract in eastern side. A crystalline rock (63%) and covered by sediments (37%). On regional scale the Charnockite body N45° E–S45° W with dipping towards SE50°.

Regional stratigraphic sequence:

AGE	FORMATION
Recent	- Quaternary Formation (Gravel)
-----Unconformity-----	
Archaean	- Charnockite
	Peninsular Gneiss complex

- Charnockite Group represented by Charnockite, Pyroxene Granulite and Magnetite Quartzite
- Peninsular Gneissic Complex (II) comprising hornblende-biotite gneiss
- Peninsular Gneissic Complex (II) comprising hornblende-biotite gneiss
- Younger intrusive comprising, Nepheline-Syenite, Pink Granite, Pegmatite and Quartz veins and
- Younger intrusive comprising, Nepheline-Syenite, Pink Granite, Pegmatite and Quartz veins and

vi Quaternary sediments of Kankar and soil

Stratigraphy of the area –

Age	Group	Lithology
Holocene		Block cotton soil/clay±gypsum
Cenozoic		Kankar/calc-tufa
Neoproterozoic	Acid intrusives	Quartz veins Pegmatite Pink Granite
	Sivamalai syenite Complex	Nepheline-syenite
	Chalk Hills (Basic Intrusives)	Pyroxenite/Dunite
Archaean – Palaeoproterozoic	Peninsular Gneissic Complex (II) PGC (II)	Pink Granite Gneiss Hornblende Biotite gneiss
Archaean	Charnockite Group	Charnockite (Unclassified) Pyroxene Granulite Banded Magnetite Quartzite

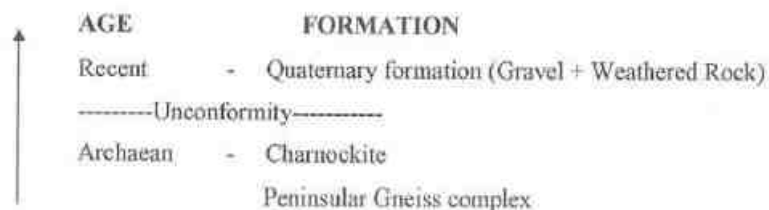
Geologically, the district is covered by rocks belonging to Archean age comprising the khondalite group, Charnockite Group, migmatite group, Sathayamangalam group, Bhavani Group and Alkali complex of Proterozoic age and Recent to Late Pleistocene rocks of Cainozoic age.

The Charnockite Group of rocks consisting of Charnockite, pyroxene granulites and associated magnetite quartzite, the Knodalite Group comprising gametiferous – sillimanite gneiss, calc-granulite, crystalline limestone, sillimanite quartzites and associated migmatitic gneisses. The rocks are restricted to the central and southern portions of the district.

Source: District Survey Report for Minor Minerals Viluppuram District – May 2019.
<https://viluppuram.nic.in/document/district-survey-report-rough-stone/Exploration> :

No Exploration is required, the Rough stone and Gravel formation is clearly inferred from the existing quarry pit situated on the south side.

The General Geological sequence of the area is given below:



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 project areas are plain terrain, The project areas are covered with Gravel formation of 2m thickness; Massive Charnockite formation is found after 2m Gravel formation which is clearly inferred from the existing quarry pit.

2.3.3 Hydrogeology

Villupuram district is underlain by crystalline metamorphic complex in the western part of the district and sedimentary tract in eastern side (Plate-II). The thickness of sediments exceeds 600m near southern part of the district. Groundwater occurs under phreatic and semi-confined conditions in consolidated formations, which comprises weathered and fractured granites, gneisses and charnockites whereas in unconsolidated sedimentary rocks the groundwater occurs in phreatic, semi-confined conditions in Vanur sandstone, Kadapperi kuppam formation and Turuvai limestone. The district is having rocky outcrops in major

part of Kallakurichi, Sankarapuram and Tirukoilur taluks. The weathering is highly erratic and the depth of abstraction structures is controlled by the intensity of weathering and fracturing. The depth of wells varies from 6.64 to 17 m bgl and water levels in observation wells tapping shallow aquifers varied from 0.74 to 9.7 m bgl during pre-monsoon (May 2006) and it varies from 0.7 to 4.45 m bgl during post monsoon (January 2007). During pre-monsoon, the depth to water levels in the range of >2 to

5 m bgl in major part of the district, in the range of >5 -10 m bgl in western and south-eastern parts of the district and range of 0-2 m bgl were recorded in two isolated pockets. During post monsoon the depth to water levels range of >2 to 5 bgl exists in major part of the district, range of 0 - 2 m bgl prevails in central and north-eastern parts of the district and range of >5 - 10 m bgl were recorded in two isolated pockets in the south-western and north western parts of the district. The depth to piezo metric surface ranged from 2.8 to 11.25 m bgl during Pre monsoon and 0.5 to 6.35 m bgl during post monsoon. The ground water is being developed by means of dug wells, bore wells and tube wells. The diameter of the well is in the range of 7 to 10 m and depth of dug wells range from 15 to 18 m bgl depending on the weathered thickness and joints. The dug wells yield up to 1 lps in summer months and few wells remain dry. The yield is adequate for irrigation for one or two crops in monsoon period. The yield of bore wells in favorable locations vary from <1 to 6 lps. The valley fills, intersection of lineaments, particularly, in the western part along the foot hills of Kalrayan hills are reported to have potential pockets suitable for dug wells and bore wells. The area of contact between crystalline and sedimentary formations has variable yield prospects. The cretaceous formations are very compact and yield prospects are low. The dug wells of 6 m diameter and 10 m bgl depth in sandy tracts give about 3.5 lps. The yield of tube wells in the sedimentary formation ranges from 2.4 to 37 lp.

2.2.2.3 Aquifer Systems:

Occurrence and storage of groundwater depend upon three factors viz., Geology, Topography and rainfall in the form of precipitation. Apart from Geology, wide variation in topographic profile and intensity of rainfall constitutes the prime factors of groundwater recharge. Aquifers are part of the more complex hydro geological system and the behaviour of the entire system cannot be interpreted easily. In hard rock terrain the occurrence of Ground Water is limited to top weathered, fissured and fractured zone which extends to maximum 30 m on an average it is about 10-15 m in Viluppuram District.

In Sedimentary formations, the presence of primary inter granular porosity enhances the transmitting capacity of groundwater where the yield will be appreciable. The sedimentary area which occupies the eastern part of the district along the coastal tract is more favourable for groundwater recharge. Ground Water occurs both in semi confined and confined conditions. A brief description of occurrence of groundwater in each formation is furnished below.

2.2.2.3 Alluvial Formations

In the river alluvium groundwater occurs under water table condition. The maximum thickness is 37 m and the average thickness of the aquifer is approximately 12 m. These formations are porous and permeable which have good water bearing zones.

Tertiary Cuddalore sandstone

Tertiary formations are represented by Cuddalore Sandstone and characterised as fluvial to brackish marine deposits. Predominantly this formation is divided into Lower and Upper Cuddalore formations. In the Upper Cuddalore formations the groundwater occurs in semi confined conditions, whereas in the Lower Cuddalore the groundwater occurs in confined condition with good groundwater potential.

Cretaceous Formations

Groundwater occurring in the lens shape in the sandy clay lenses and fine sand is underlain by white and black clay beds which constitute phreatic aquifer depth which ranges 10m to 15m below ground level. Phreatic aquifer in Limestone is potential due to the presence of Oolitic Limestone.

Hard Rock Formations

Groundwater occurs under water table conditions but the intensity of weathering, joint, fracture and its development is much less in other type of rocks when compared to gneissic formation. The groundwater potential is low, when compared with the gneissic formations

Granitic Gneiss

Groundwater occurs under water table conditions in weathered, jointed and fractural formations. The pore space developed in the weathered mantle acts as shallow granular aquifers and forms the potential water bearing and yielding zones water table is shallow in canal and tank irrigation regions and it is somewhat deeper in other regions.

Charnockite

Groundwater occurs under water table conditions but the intensity of weathering, joint, fracture and its development is much less when compared to gneissic formations. The groundwater potential is low, when compared with the gneissic formations.

Aquifer Parameters

The transmissivity values of fractured aquifers range from < 1 to $141 \text{ m}^2/\text{day}$ and storativity varies between 2.84×10^{-5} and 8.9×10^{-3} . The transmissivity of sedimentary formation varies from 21 to $748 \text{ m}^2/\text{day}$ and storativity is in the order of 2.75×10^{-3}

Actual Rainfall in Mm					Normal Rainfall in Mm
2017	2018	2019	2020	2021	
1066.9	727.5	906.3	1137.7	1935.2	985

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

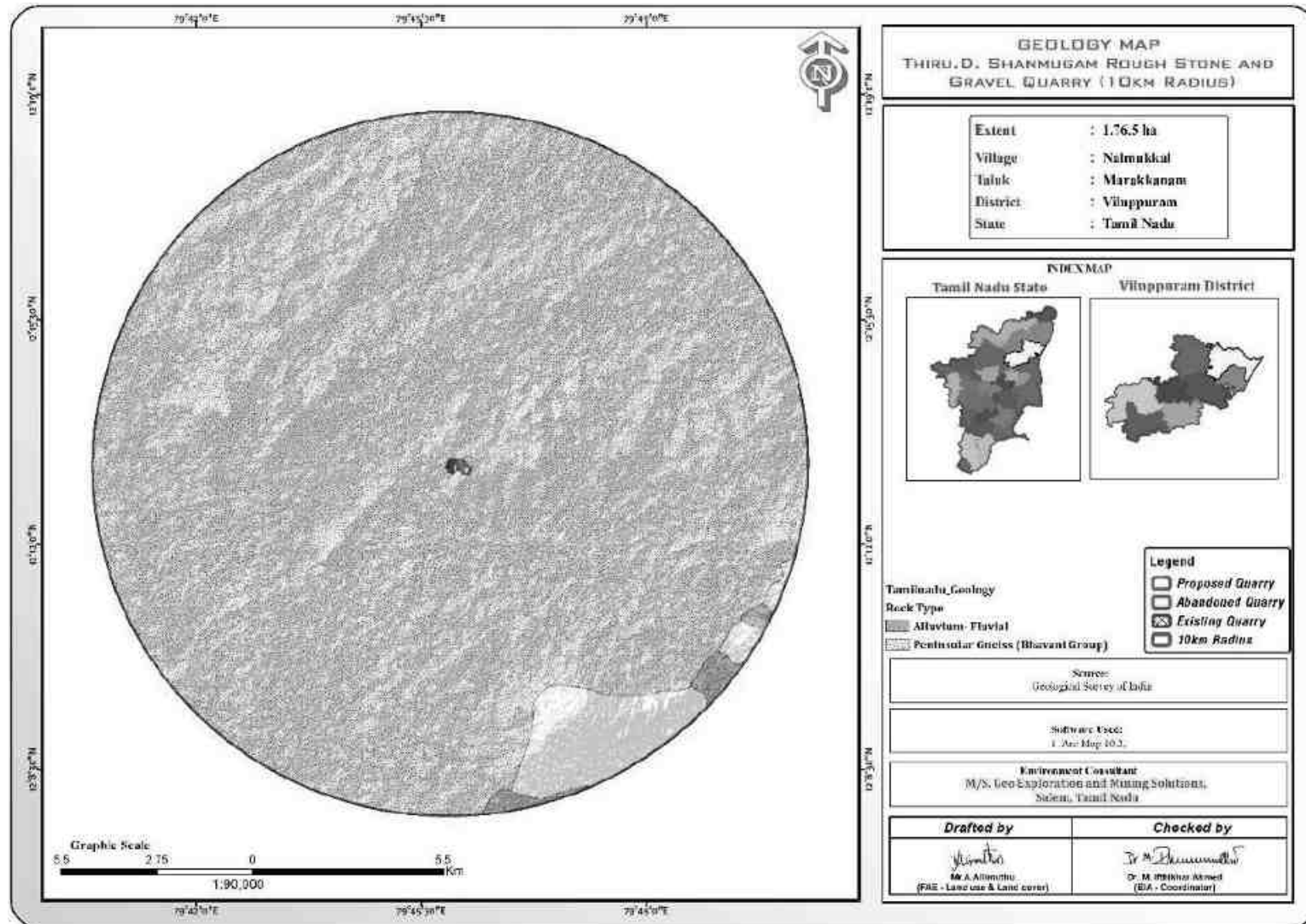
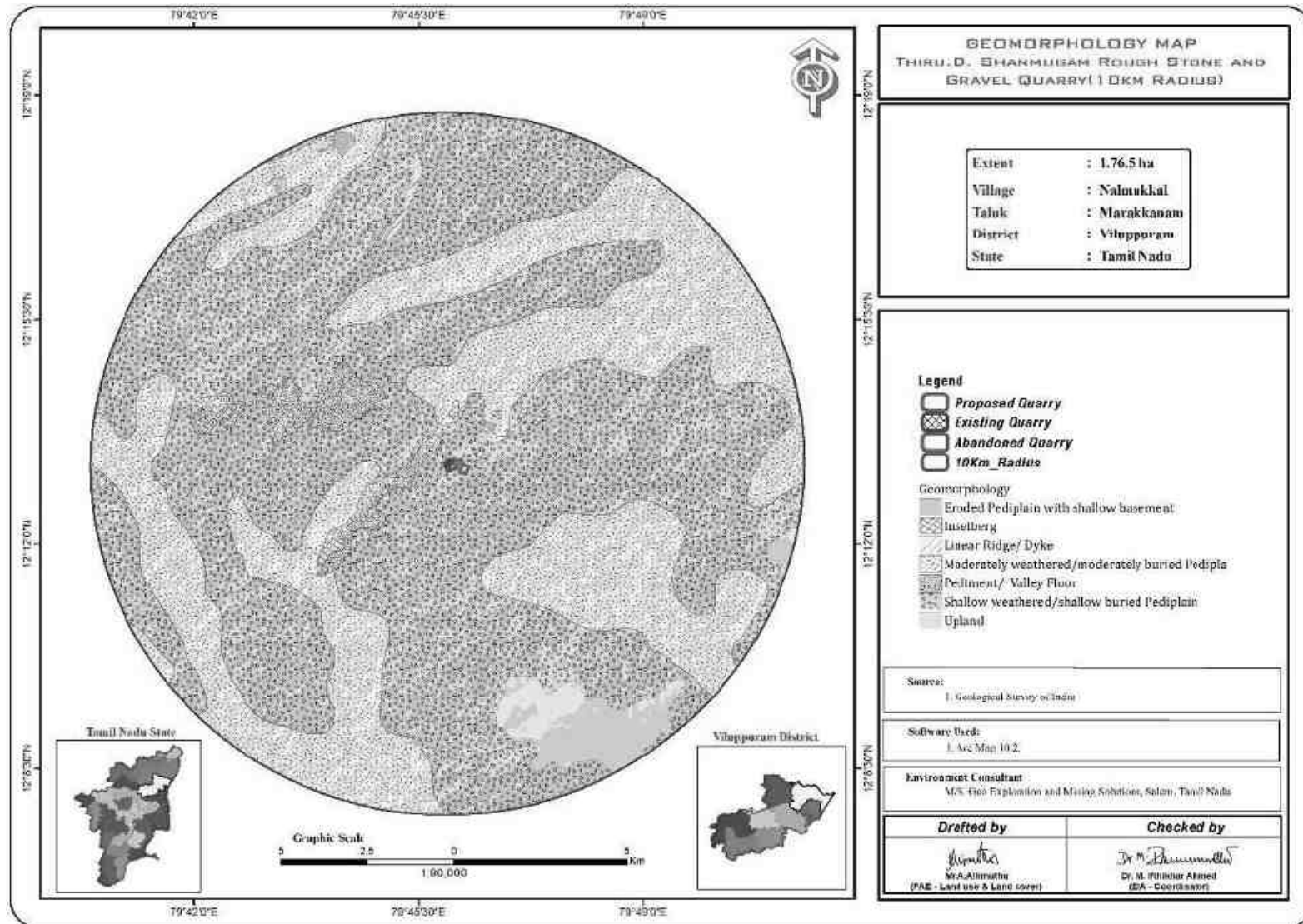
FIGURE 2.9: REGIONAL GEOLOGY MAP

FIGURE 2.10: GEOMORPHOLOGY 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 2.5: RESOURCES AND RESERVES

Description	Rough Stone m ³	Gravel m ³
Geological Resource in m ³	617750	35300
Mineable Resource in m ³	151259	24648
Year wise production for 1 st five-year plan period	77478	24648
Year wise production for 2 nd five-year plan period	73781	-

Source: Approved Mining Plan

TABLE 2.6: YEAR-WISE PRODUCTION PLAN

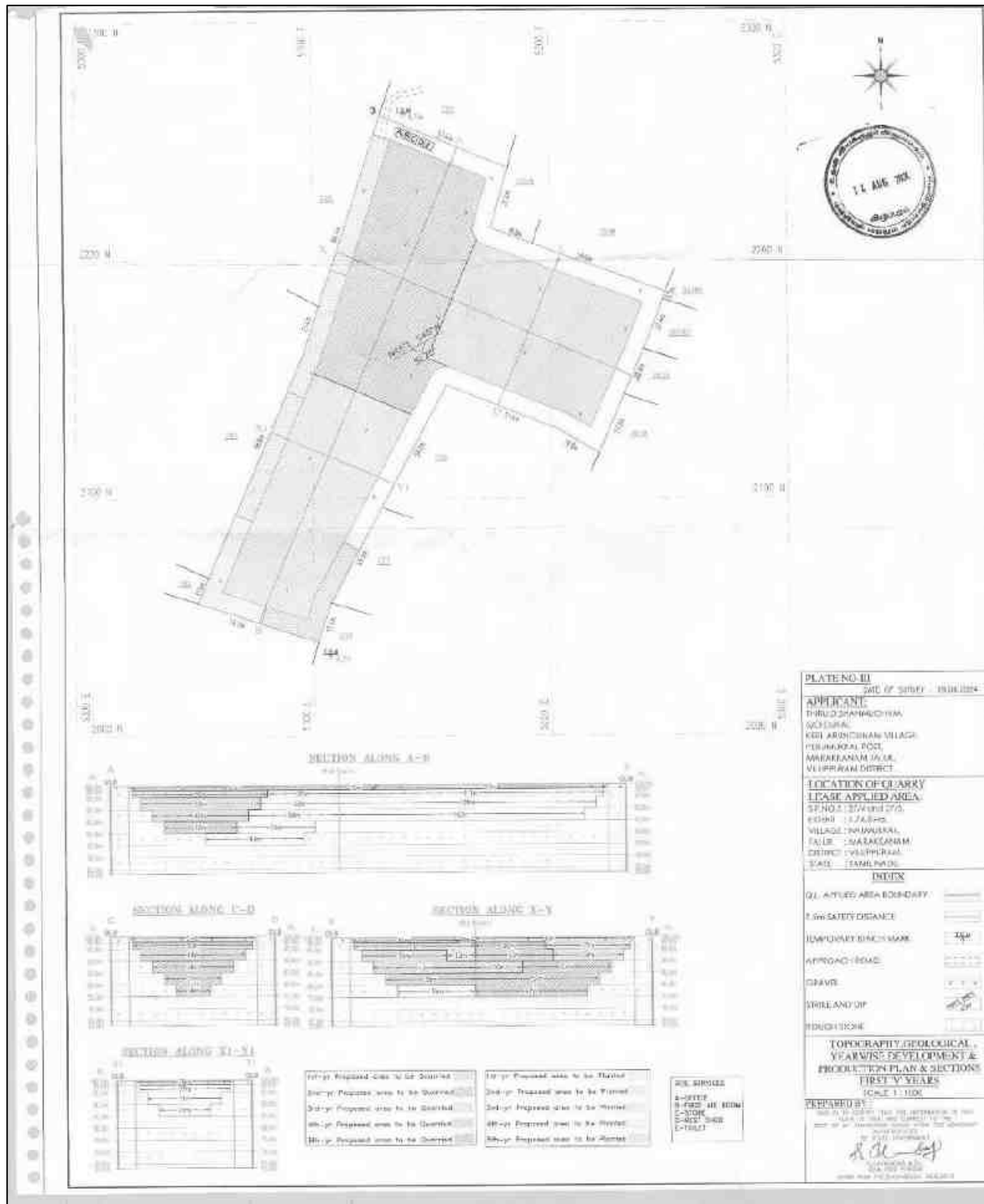
YEAR	ROUGH STONE (m ³)	GRAVEL (m ³)
I	11630	8256
II	11760	8826
III	11568	7566
IV	21000	-
V	21520	-
VI	16911	-
VII	16910	-
VIII	18565	-
IX	14630	-
X	6765	-
TOTAL	1,51,259	24,648

Source: Approved Mining Plan

Disposal of Waste

The overburden in the form of Gravel formation is about 24,648m³ up to depth 2m for during this period. the Gravel will be directly loaded into tippers for the filling and levelling of low-lying areas, this will be done only after obtaining permission and paying necessary seigniorage fees to the Government.

**FIGURE 2.11: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT
PRODUCTION PLAN AND SECTIONS**



Source: Approved Mining Plan

Conceptual Mining Plan/ Final Mine Closure Plan

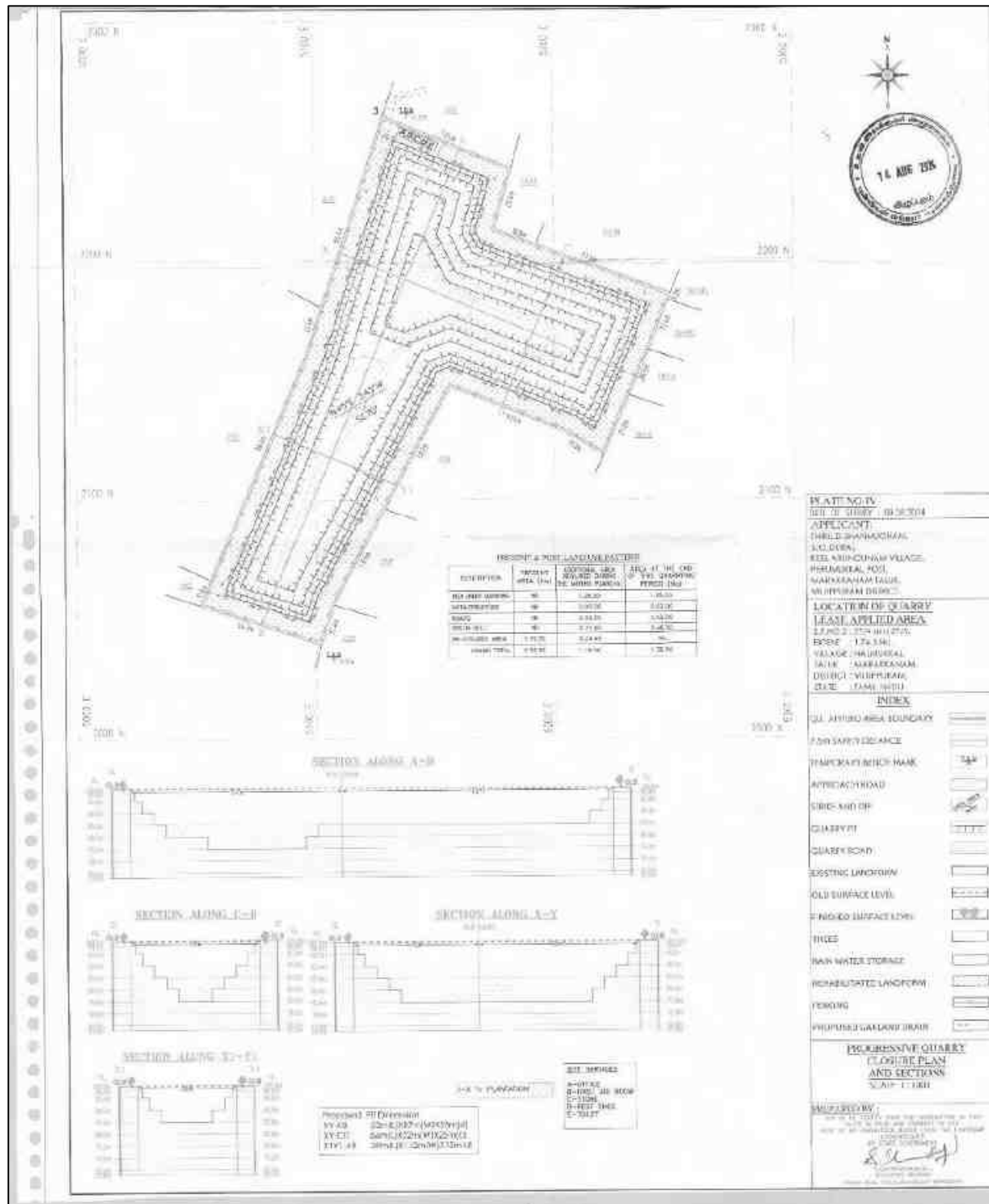
The ultimate pit size is designed based on certain practical parameters such as economical depth of mining, safety zones, permissible area, etc.

TABLE 2.7: ULTIMATE PIT DIMENSION

Pit	Length (Max) (m)	Width (Max) (m)	Depth (Max)
XY-AB	52	87	20m bgl
XY-CD	66	52	25
X1Y1-AB	39	112	15

Source: Approved Mining Plan

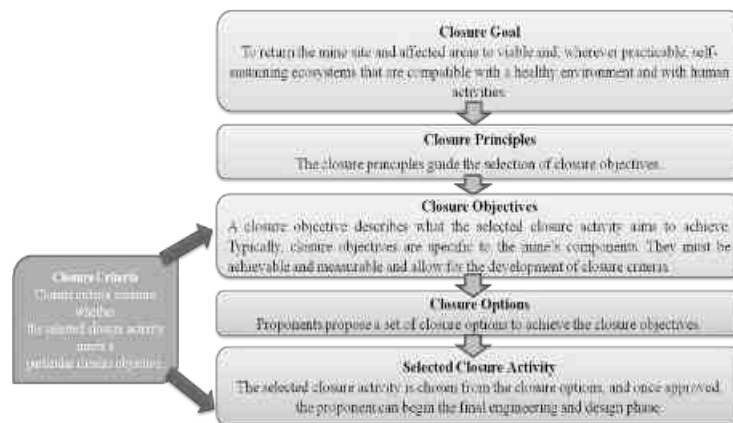
FIGURE 2.12: CLOSURE PLAN AND SECTIONS



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 stake holders
- Construction of 2m height bund all along the mine pit boundary and ensure its stability all time & construction of garland drain along the natural slope to avoid sliding and collection of soil to the pit & surface runoff during rainfall
- After complete exploitation of mineral, the lowest bench foot wall side will be maintained as plain surface without any sump pits to avoid any accidents
- All the sharp edges will be dressed to smoother face before the closure of mine and ensure no loose debris on hanging wall side
- 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

Open cast 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	–	1.0m
Burden	–	0.75 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
Peak production Capacity	=	72m 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 2.6 (Bulk Density) = 4.6Ts per hole

hence for the peak production of 72m³ (187Ts) = 62 Nos of holes to be drilled per day

Explosives per hole = ½ kg hence 25 kg 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 2.8 PROPOSED MACHINERY DEPLOYMENT

S.NO.	TYPE	NOS	SIZE/CAPACITY	MOTIVE POWER
1	Hand Jack hammers	3	1.2m to 2.0m	Compressed air
2	Compressor	1	400psi	Diesel Drive
3	Excavator with Bucket and Rock Breaker	1	300 HP	Diesel Drive
4	Tippers	2	20 Tonnes	Diesel Drive

Source: Approved Mining Plan

2.6 PROJECT DESCRIPTION

2.6.1 Existing Infrastructures

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

2.6.2 Drainage Pattern

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

1. Budderi Village Road (Village Road)
2. Tindivanam to Marakkanam (state highway Road)

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.2.9: TRAFFIC SURVEY LOCATIONS

Station Code	Road Name	Distance and Direction	Type of Road
--------------	-----------	------------------------	--------------

TS1	Budderi Village Road	600m-NW	Village Road
TS2	Tindivanam to Marakkanam SH Road	2.8km-SW	SH Road

Source: On-site monitoring by GEMS FAE & TM

TABLE 2.10: EXISTING TRAFFIC VOLUME

Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	110	330	60	60	80	40	430
TS2	210	630	120	120	140	70	820

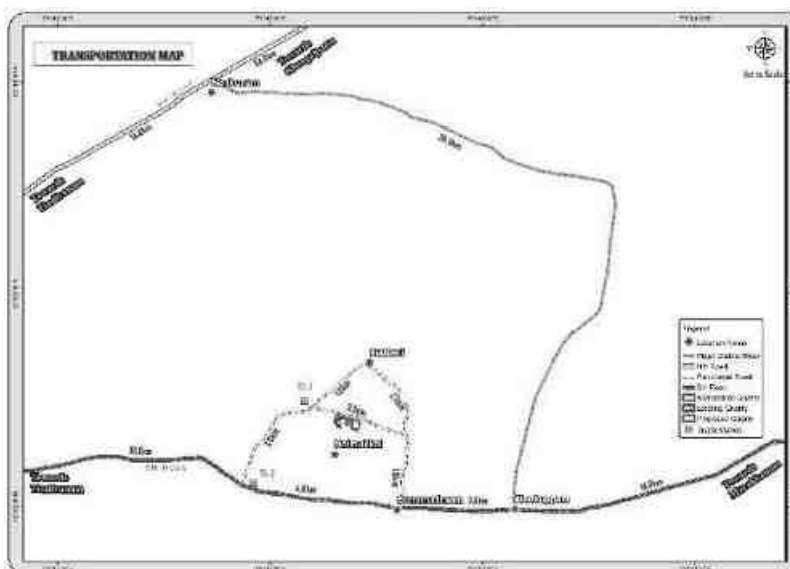
Source: On-site monitoring by GEMS FAE & TM

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

TABLE 2.11: 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	15	45

FIGURE.2.13: MINERAL TRANSPORTATION ROUTE MAP



Proposed Transportation Route:

1. The Rough stone will be transported to the Crusher which is located 70m East side of the project site.
2. No Major Habitation, Schools in the proposed transportation route.

TABLE 2.12: 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
Budderi Village Road	430	45	475	1500
Tindivanam to Marakkanam SH Road	820	45	865	1200

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

- Due to these projects the existing traffic volume will not exceed

- As per the IRC 1960 this existing District road can handle 1,200 PCU in hour and State Highway 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 2.13: WATER REQUIREMENT FOR THE PROJECT

Purpose	Quantity	Source
Dust Suppression	0.7KLD	From the existing pit or from the water vendors
Green Belt	0.6KLD	From the existing pit or from the water vendors
Sanitation & Drinking	0.3KLD	From the existing pit or from the water vendors.
Total	1.6 KLD	

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

One Excavator will excavate 25m³ of Broken up Rough stone per hour and 60m³ of Gravel per hour.

Peak production of Rough stone = 72m³

Peak production of Gravel = 29m³

Type of machinery	Working hours	Average Diesel consumption/ Hour	Quantity of Diesel in Ltrs
Working hours of Excavator (Aprx)	72m ³ /20 m ³ = 4 Hrs (Rough stone)	18 Ltrs	72
	29/60m ³ = 1-2 Hrs	18 Ltrs	18
Compressor	Working hours per day 3 Hrs	8 Ltrs	24
Tippers, Motor pumps to drain water	Occasionally		20
Total Diesel Consumption			134

The Maximum diesel consumption is around 134 Ltrs per day considering the peak production.

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.67,25,000/-

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 2.14: PROPOSED MANPOWER DEPLOYMENT

Designation	No of persons
Mines Manager	1
Geologist	1
Mines Foreman	1
Mate/Blaster	1
Jack hammer operator	6
Tipper Driver	2
Water Sprinkler driver	1
Excavator Operator	1
Labour & Helper	2
Cleaner & Co-operator	4
Security	1
Total	21

Source: Approved Mining Plan & Pre-Feasibility report.

2.9 PROPOSED SCHEDULE FOR APPROVAL AND IMPLEMENTATION

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).

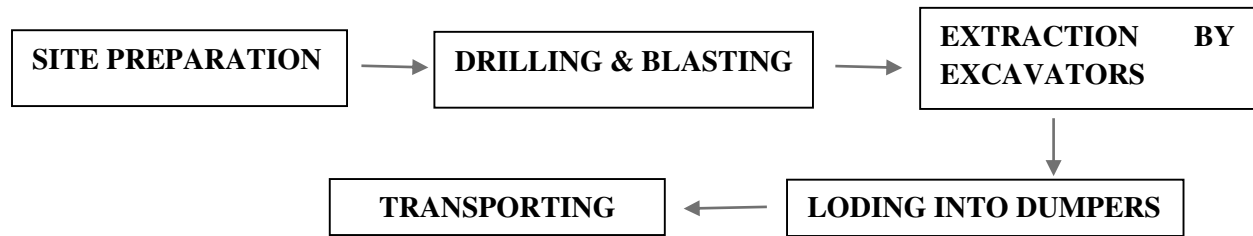
TABLE 2.15: EXPECTED TIME SCHEDULE

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.

2.10 TECHNOLOGY AND PROCESS DESCRIPTION

The Technology used in the for the operation is Opencast Method by using drilling, Blasting and Excavation and mineral transport through tippers. The flowchart of this project is given below



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 2024 to February 2025 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 EHS 360 Lab Private Limited, – An accredited by ISO/IEC 17025:2017 (NABL).

3.1 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.

3.2 STUDY PERIOD

The baseline study was conducted during the Winter season i.e., December 2023 to February 2024.

3.3 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's 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	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
*Ambient Air Quality	PM10 PM2.5 SO2 NOX Fugitive Dust	24 hourly twice a week (December 2024 – February 2025)	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 EHS 360 in association with GEMS

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

3.5 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

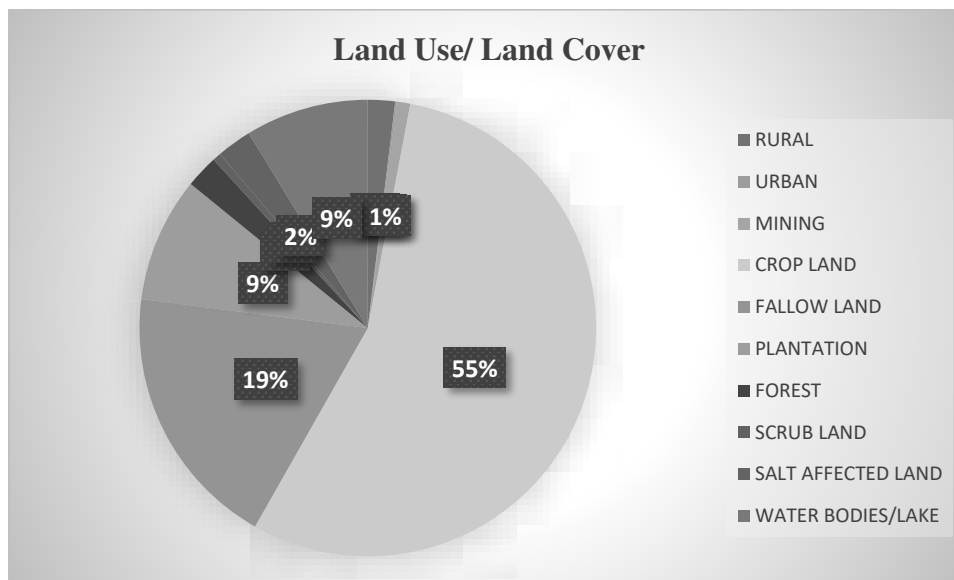
A visual interpretation technique has been adopted for land use classification based on the keys suggested in the chapter – V of the guidelines issued by NNRMS Bangalore & Level III classification with 1:50,000 scale for the preparation of land use mapping. Land use pattern of the area was studied through 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 in HA	AREA in %
BUILTUP			
1	Urban	35.08	0.12
2	Rural	614.58	2.02
3	Mining	305.83	1.00
AGRICULTURAL LAND			
4	Crop land	17693.40	58.02
5	Fallow Land	6023.89	19.75
6	Plantation	2834.50	9.29
FOREST			
7	Forest	743.93	2.44
BARREN/WASTE LANDS			
8	Scrub Land	193.41	0.63
9	Salt Affected Land	792.29	2.60
WETLANDS/ WATER BODIES			
10	Water bodies/lake/river	2796.93	9.17
TOTAL		30497.62	100.00

Source: Survey of India Toposheet and Landsat Satellite Imagery

FIGURE 3.1: PIE DIAGRAM OF LAND USE AND LAND COVER



From the above table, pie diagram and land use map it is inferred that the majority of the land in the study area is Agriculture and fallow land (includes crop land) 87.06% followed by Built-up Lands – 2.14%, Scrub land – 0.63%, and Water bodies 9.17%.

The total mining area within the study area is 305.83 ha i.e., 1.00%. The cluster area of 9.06.5 ha contributes about 2.96% 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 North-eastern side. The altitude of the area is 82m AMSL. The area is covered by 2m thickness of gravel & followed by massive charnockite which is clearly inferred from the surface outcrops.

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, low damage risk zone as per BMTPC, Vulnerability Atlas of Seismic zone of India IS: 1893 – 2002. The project area falls in the hard rock terrain on the peninsular shield of south India which is highly stable.

3.1.5 Environmental Features in the Study Area

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

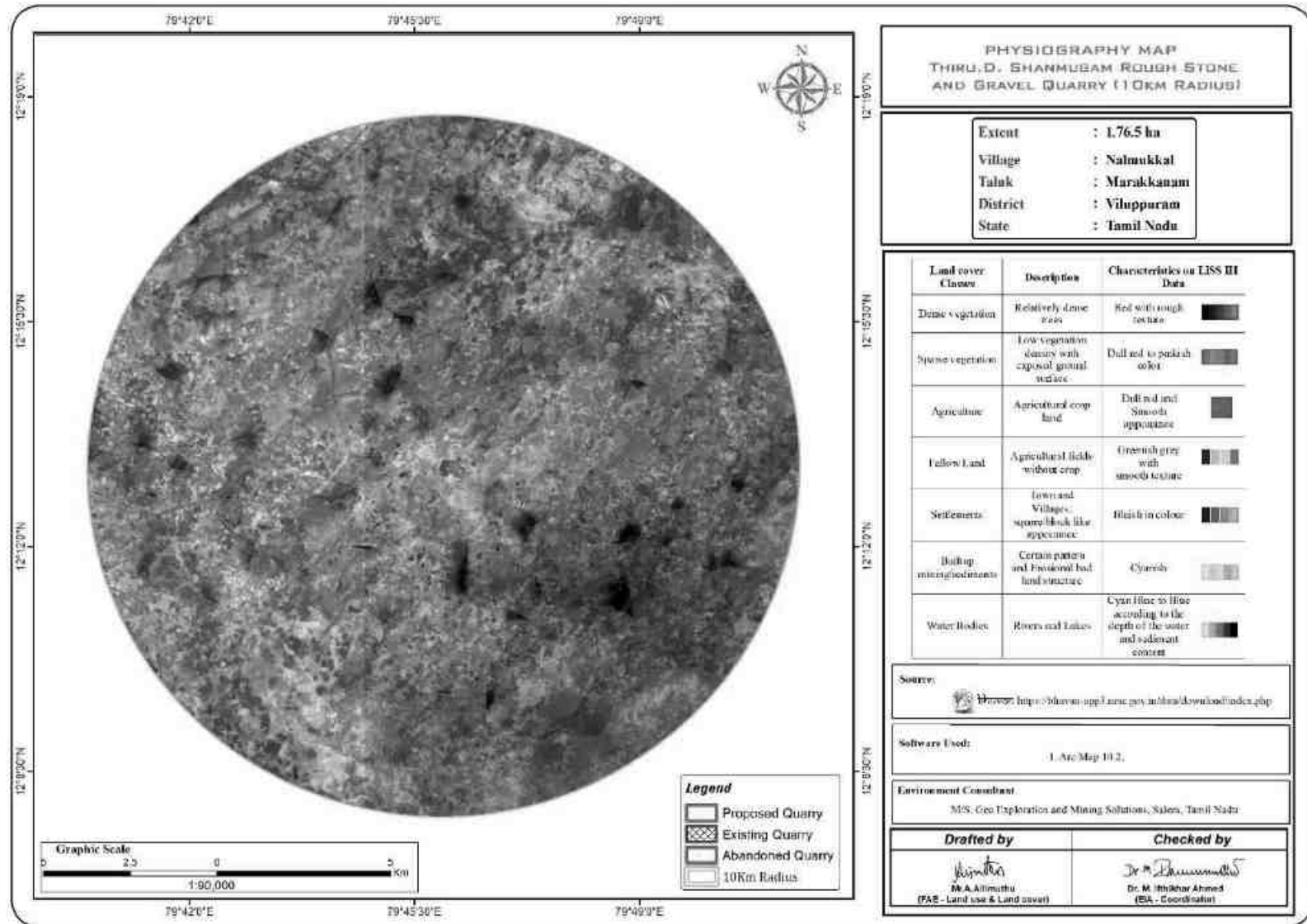
FIGURE 3.2: PHYSIOGRAPHIC MAP 10KM RADIUS

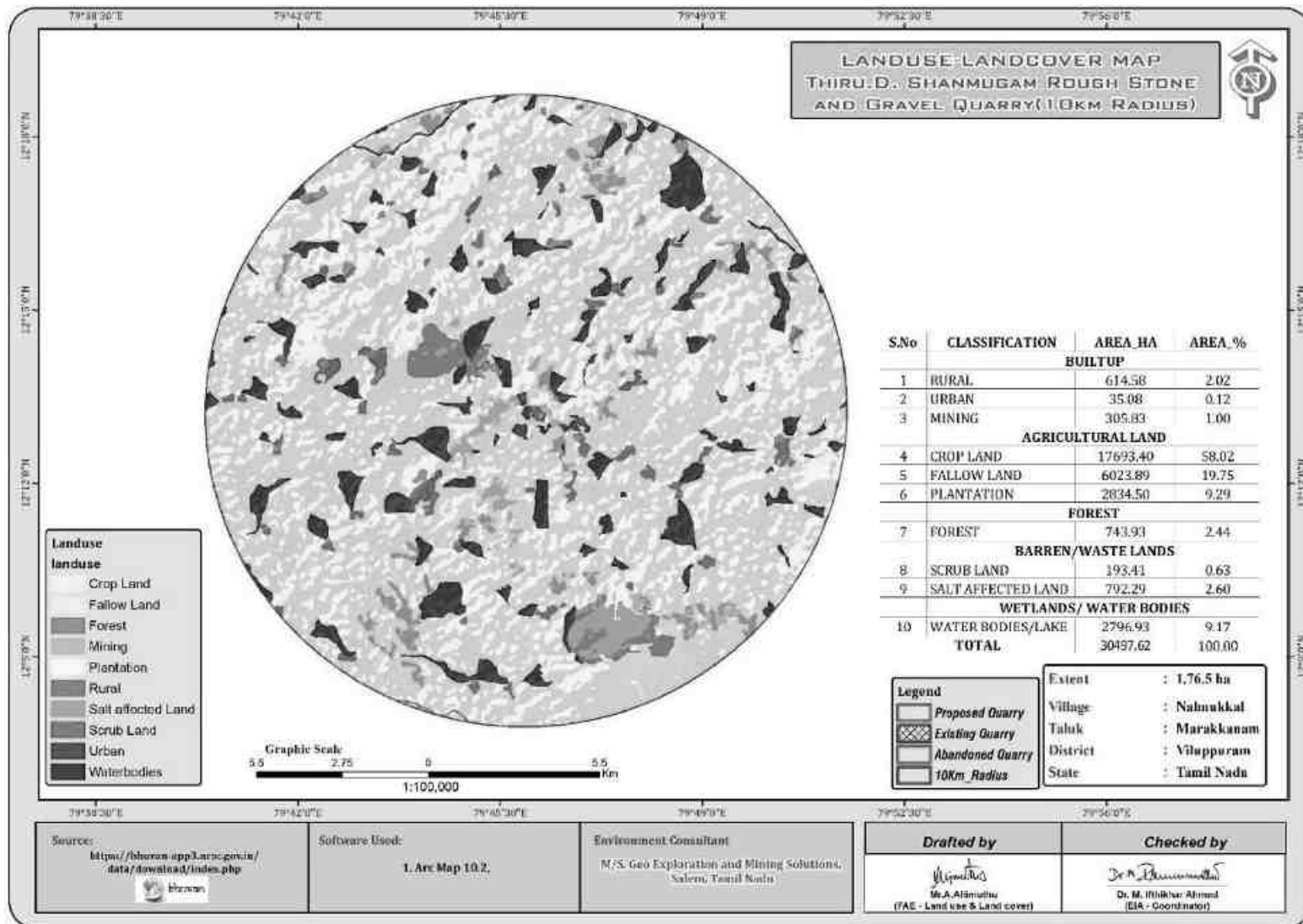
FIGURE 3.3: LAND USE LAND COVER MAP 10KM RADIUS

TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER

Sl.No	Sensitive Ecological Features	Name	Arial Distance in km from Cluster
1	National Park / Wild life Sanctuaries	Kazhuveli Birds Sanctuary Oussudu Lake Birds Sanctuary	13.26km- SE 27.31km-South
2	Reserve Forest	Kilsevrur	3.70km – North West (Source – DFO Letter)
3	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10Km Radius
4	Critically Polluted Areas	SIPCOT industrial Complex, Cuddalore	57.3km- South East
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

Sl.No	NAME	DISTANCE & DIRECTION
1	Nalmukkal Eri	250m South
2	Odai	480m SW
3	Kunnappakkam Lake	870m NE
4	Budderi	880m NW
5	Ariyanthangal Eri	1.3km SE
6	Perumukkal Eri	2.3km SW

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 3.5.

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	12°13'16.99"N 79°45'56.66"E
2	S-2	Near Existing Quarry	230m NE	12°13'19.91"N 79°46'5.40"E
3	S-3	Eappakkam	5.5km NW	12°16'10.16"N 79°45'1.65"E
4	S-4	Olagapuram	6km SE	12° 9'56.97"N 79°46'25.13"E
5	S-5	Perumukkal	4km SW	12°12'40.71"N 79°43'33.96"E
6	S-6	Vadanerkunam	6.2km NE	12°14'34.80"N 79°49'13.48"E

Source: On-site monitoring/sampling by EHS 360 lab 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 EHS360 Labs 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.

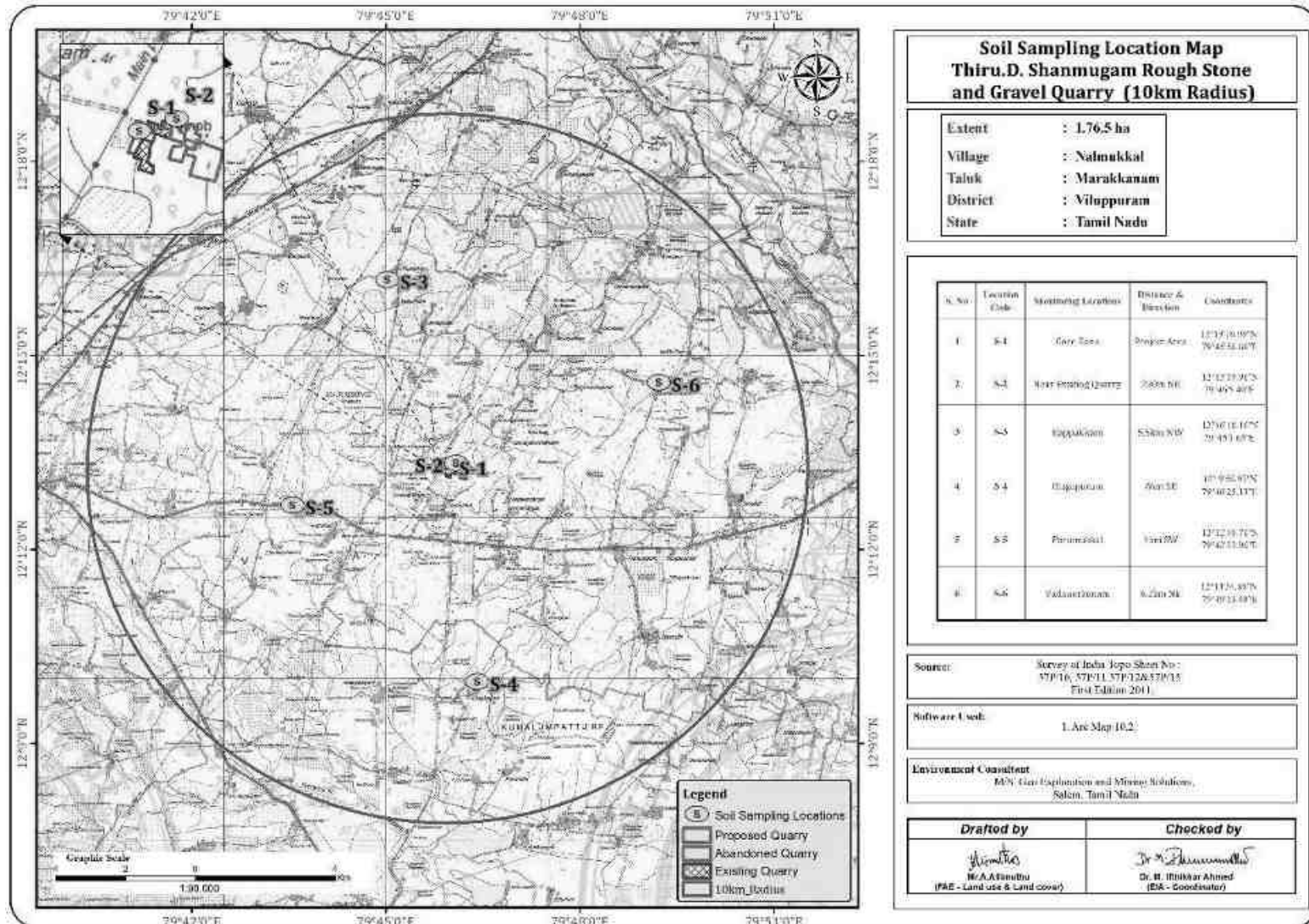
FIGURE 3.4: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS

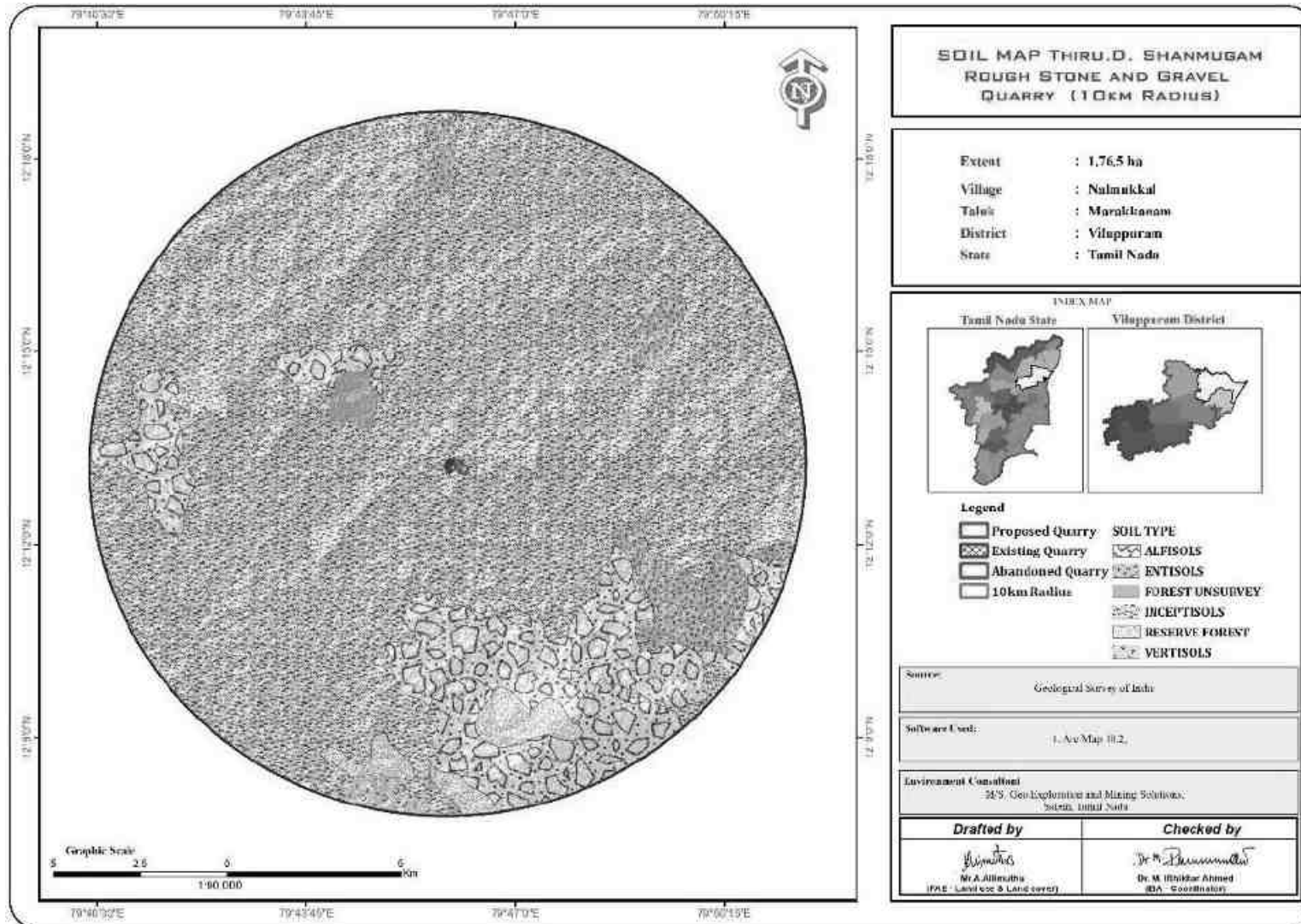
FIGURE 3.5: SOIL MAP

TABLE 3.7: SOIL QUALITY OF THE STUDY AREA

Parameter		Unit	S-1 Core Zone	S-2 Near Existing quarry	S-3 Eappakkam	S-4 Olagapuram	S-5 Perumukkal	S-6 Vadanerkunam
1	pH @ 25°C	-	6.52	7.32	7.34	7.62	7.57	7.14
2	Conductivity @ 25°C	μmhos/cm	415 μmhos/cm	325 μmhos/cm	429 μmhos/cm	396 μmhos/cm	424 μmhos/cm	278 μmhos/cm
3	Water Holding Capacity	%	43.3 %	43.5 %	46.1 %	43.7. %	46.4 %	36.8 %
4	Bulk Density	g/cm ³	1.06 g/cm ³	1.06 g/cm ³	0.87 g/cm ³	1.10 g/cm ³	1.13 g/cm ³	1.01 g/cm ³
5	Porosity	%	41.7 %	39.4 %	43.9 %	39.7 %	42.1 %	32.5%
6	Calcium as Ca	mg/kg	101 mg/kg	87.8 mg/kg	76.4 mg/kg	78.6 mg/kg	86.4 mg/kg	80.5 mg/kg
7	Magnesium as Mg	mg/kg	44.2 mg/kg	32.8 mg/kg	31.8 mg/kg	28.5 mg/kg	28.6 mg/kg	27.4 mg/kg
8	Chloride as Cl	mg/kg	89.5 mg/kg	99.8 mg/kg	96.8 mg/kg	95.9 mg/kg	96.7 mg/kg	93.4 mg/kg
9	Soluble Sulphate as SO ₄	%	0.013 %	0.0011 %	0.0021 %	0.0029 %	0.0027 %	0.0023 %
10	Total Phosphorus as P	mg/Kg	0.99 mg/kg	3.24 mg/kg	2.03 mg/kg	2.01 mg/kg	2.73 mg/kg	2.74 mg/kg
11	Total Nitrogen as N	mg/Kg	232 mg/kg	368 mg/kg	435 mg/kg	396 mg/kg	473 mg/kg	437 mg/kg
12	Organic Matter	%	1.82 %	1.67%	1.99%	2.13 %	2.44 %	2.68 %
13	Organic Carbon	%	1.06 %	0.97 %	1.16 %	1.24 %	1.42 %	1.56 %
14	Texture :							
	Clay	%	24.6 %	26.2 %	25.1 %	23.3 %	22.3 %	23.2 %
	Sand	%	35.6 %	35.2 %	34.8 %	37.2 %	36.5 %	36.2 %
	Silt	%	39.8 %	38.6 %	40.1 %	39.5 %	41.2 %	40.6 %
15	Manganese as Mn	mg/Kg	17.2 mg/kg	23.1 mg/kg	26.4 mg/kg	23.6 mg/kg	20.2 mg/kg	23.4 mg/kg
16	Zinc as Zn	mg/Kg	0.88 mg/kg	1.28mg/kg	1.47 mg/kg	1.76 mg/kg	1.42 mg/kg	1.27 mg/kg
17	Boron as B	mg/Kg	1.47 mg/kg	1.05 mg/kg	0.82 mg/kg	1.37 mg/kg	1.62 mg/kg	1.33 mg/kg
18	Potassium as K	mg/Kg	27.2 mg/kg	19.7 mg/kg	27.3 mg/kg	26.4 mg/kg	29.9 mg/kg	22.1 mg/kg
19	Cadmium as Cd	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)	BDL (DL : 1.0 mg/kg)
20	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)
21	Copper as Cu	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)	BDL (DL : 1.0 mg/kg)
22	Lead as Pb	mg/Kg	0.86 mg/kg	0.75 mg/kg	1.87 mg/kg	1.43 mg/kg	0.82 mg/kg	1.09 mg/kg
23	Iron as Fe	mg/Kg	2.91 mg/kg	3.85 mg/kg	4.45 mg/kg	.47 mg/kg	5.21 mg/kg	4.32 mg/kg
24	Cation Exchange Capacity	meq/100g	34.2 meq/100g of soil	29.7 meq/100g of soil	23.8meq/100g of soil	29.6 meq/100g of soil	30.2 meq/100g of soil	29.8 meq/100g of soil

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 (22.3 % to 26.2%) to Sandy Loam Soil and Bulk Density of Soils in the study area varied between 0.87– 1.13 g/cm³. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e., ranging from 36.8 – 46.4 %. and 32.5-43.9 %.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 6.52 to 7.62
- The available Nitrogen content range between 232 to 473 mg/kg
- The available Phosphorus content range between 0.99 to 3.24 mg/kg
- The available Potassium range between 19.7 mg/kg to 29.9 mg/kg

Observation:

The pH of the Soil indicates that the soil is Neutral and arid region and ideal for plant growth.

3.6 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:

Sangarabarani River 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 3.5.

TABLE 3.8: WATER SAMPLING LOCATIONS

S.NO	CODE	LOCATIONS	DISTANCE & DIRECTION	CO-ORDINATES
SURFACE WATER				
1	SW-1	Nalmukkal Eri	640m South	12°12'50.39"N 79°45'51.59"E
2	SW-2	Keelpasar Eri	5.4km NE	12°16'9.42"N 79°46'17.50"E
GROUND WATER				
3	WW-1	Near Project Area	160m SW	12°13'9.36"N 79°45'49.13"E
4	WW-2	Vadanerkunam	6.5km NE	12°14'38.90"N 79°49'18.21"E
5	BW-1	Near Project Area	330m NW	12°13'23.49"N 79°45'46.50"E
6	BW-2	Olagapuram	6km SE	12° 9'52.66"N 79°46'28.22"E

Source: On-site monitoring/sampling by EHS 360 Lab Private Limited in association with GEMS

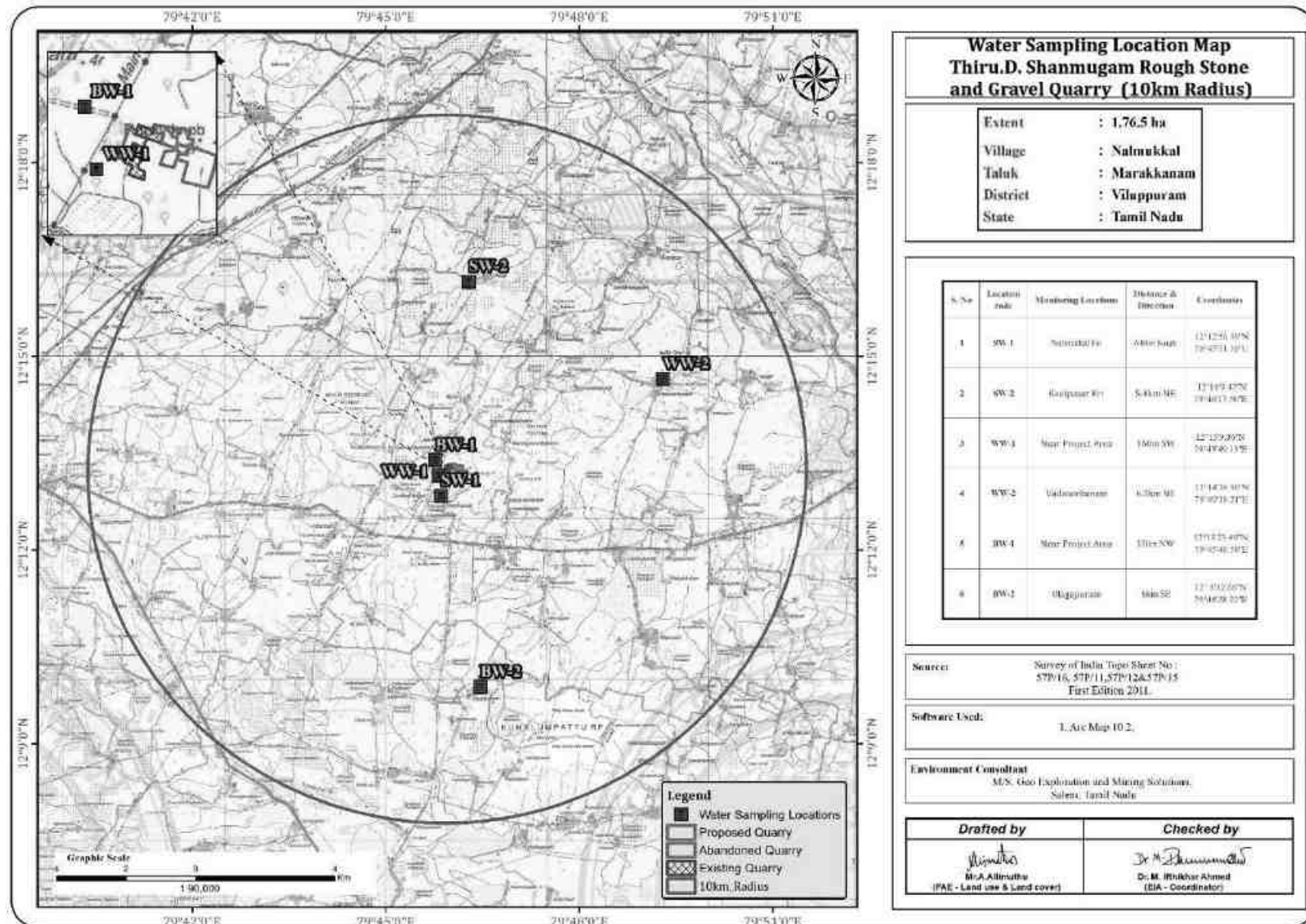
FIGURE 3.6: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS

TABLE 3.9: GROUND WATER SAMPLING RESULTS

S.NO	Parameter	BW-1 Near Project Area	BW-2 Olagapuram	WW-1 Near Project Area	WW-2 Vadanerkunam
1	Color	< 5	5	< 5	< 5
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3	pH@ 25°C	7.62	7.45	7.56	7.36
4	Electrical Conductivity @ 25°C	1200.0 µmhos/cm	736.0 µmhos/cm	1333.0 µmhos/cm	1112.3 µmhos/cm
5	Turbidity	< 1 NTU	1.0 NTU	< 1 NTU	1.0 NTU
6	Total Dissolved Solids	708.0 mg/l	434.0 mg/l	786.0 mg/l	658.6 mg/l
7	Total Hardness as CaCO ₃	200.0 mg/l	160.0 mg/l	280.0 mg/l	240.0 mg/l
8	Calcium as Ca	46.4 mg/l	41.6 mg/l	62.5 mg/l	52.3 mg/l
9	Magnesium as Mg	20.4 mg/l	13.6 mg/l	30.1 mg/l	26.2 mg/l
10	Total Alkalinity	178.6 mg/l	129.6 mg/l	258.0 mg/l	221.4 mg/l
11	Chloride as Cl ⁻	235.5 mg/l	187.6 mg/l	309.8 mg/l	282.5 mg/l
12	Sulphate as SO ₄ ⁻	40.2 mg/l	38.8 mg/l	56.9 mg/l	48.9 mg/l
13	Iron as Fe	0.23 mg/l	0.24 mg/l	0.38 mg/l	0.29 mg/l
14	Free Residual Chlorine	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)
15	Fluoride as F	0.27 mg/l	0.2 mg/l	0.32 mg/l	0.36 mg/l
16	Nitrates as NO ₃	3.3 mg/l	6.1 mg/l	4.6 mg/l	6.3 mg/l
17	Copper as Cu	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
18	Manganese as Mn	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
19	Mercury as Hg	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
20	Cadmium as Cd	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)
21	Selenium as Se	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
22	Aluminium as Al	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
23	Lead as Pb	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
24	Zinc as Zn	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
25	Total Chromium	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)
26	Boron as B	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
27	Mineral Oil	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)
28	Phenolic Compounds as C ₆ H ₅ OH	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
29	Anionic Detergents as	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
30	Cynaide as CN	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
31	Barium as Ba	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)
32	Ammonia (as total ammonia-N)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
33	Sulphide as H ₂ S	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
34	Molybdenum as Mo	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
35	Total Arsenic as As	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
36	Total Suspended Solids	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)	BDL (DL:1.0 mg/l)
37	Total Coliform	166 MPN/100ml	137 MPN/100ml	92 MPN/100ml	115 MPN/100ml
38	E-Coli	< 1.8 MPN/100ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml	< 1.8 MPN/100ml

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

TABLE 3.10: SURFACE WATER SAMPLING RESULTS

Sl. No.	Parameter	Unit	RESULT	
			SW1- Nalmukkal Eri	SW2- Keelpasar Eri
1	Colour	Hazen	7 Hazen	7 Hazen
2	Odour	-	Agreeable	Agreeable
3	pH@ 25°C	-	8.13	8.09
4	Electrical Conductivity @ 25°C	µs/cm	1841 µmhos/cm	1625.0 µmhos/cm
5	Turbidity	NTU	3.6 NTU	6.2 NTU
6	Total Dissolved Solids	mg /l	1086 mg/l	959.0 mg/l
7	Total Hardness as CaCO ₃	mg/l	400.0 mg/l	360.0 mg/l
8	Calcium as Ca	mg/l	94.6 mg/l	83.3 mg/l
9	Magnesium as Mg	mg/l	39.8 mg/l	36.9 mg/l
10	Total Alkalinity as CaCO ₃	mg/l	386.0 mg/l	329.0 mg/l
11	Chloride as Cl ⁻	mg/l	425.0 mg/l	377.0 mg/l
12	Sulphate as SO ₄ ⁻	mg/l	75.6 mg/l	52.5 mg/l
13	Iron as Fe	mg/l	0.46 mg/l	0.39 mg/l
14	Free Residual Chlorine	mg/l	BDL (DL:0.1 mg/l)	BDL (DL:0.1 mg/l)
15	Fluoride as F	mg/l	0.41 mg/l	0.5 mg/l
16	Nitrates as NO ₃	mg/l	9.2 mg/l	12.2 mg/l
17	Copper as Cu	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
18	Manganese as Mn	mg/l	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
19	Mercury as Hg	mg/l	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
20	Cadmium as Cd	mg/l	BDL (DL:0.001 mg/l)	BDL (DL:0.001 mg/l)
21	Selenium as Se	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
22	Aluminium as Al	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
23	Lead as Pb	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
24	Zinc as Zn	mg/l	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
25	Total Chromium	mg/l	BDL(DL : 0.02 mg/l)	BDL(DL : 0.02 mg/l)
26	Boron as B	mg/l	BDL(DL : 0.05 mg/l)	BDL(DL : 0.05 mg/l)
27	Mineral Oil	mg/l	BDL(DL : 0.01 mg/l)	BDL(DL : 0.01 mg/l)
28	Phenolic Compounds as C ₆ H ₅ OH	mg/l	BDL (DL:0.0005 mg/l)	BDL (DL:0.0005 mg/l)
29	Anionic Detergents as MBAS	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
30	Cyanide as CN	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
31	Biological Oxygen Demand, 3 days @ 27°C		12.3 mg/l	11.2 mg/l
32	Chemical Oxygen Demand		40.16 mg/l	30.24 mg/l
33	Dissolved Oxygen		6.3 mg/l	5.9 mg/l
34	Barium as Ba	mg/l	BDL(DL:0.05 mg/l)	BDL(DL:0.05 mg/l)
35	Ammonia (as Total Ammonia-N)	mg/l	2.9 mg/l	4.2 mg/l
36	Sulphide as H ₂ S	mg/l	BDL (DL:0.01 mg/l)	BDL (DL:0.01 mg/l)
37	Molybdenum as Mo	mg/l	BDL (DL:0.02 mg/l)	BDL (DL:0.02 mg/l)
38	Total Arsenic as As	mg/l	BDL (DL:0.005 mg/l)	BDL (DL:0.005 mg/l)
39	Total Suspended Solids	mg/l	8.3 mg/l	8.6 mg/l
40	Total Coliform	MPN/ 100ml	578 MPN/100ml	557 MPN/100ml
41	E-Coli		55 MPN/100ml	90 MPN/100ml

Note : APHA – American Public Health Association, BDL – Below Detection Limit, DL – Detection Limit, MPN – Most Probable Number.

3.2.4 Interpretation & Conclusion

Surface Water

The pH varied from 8.09 to 8.13 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 959 to 1086 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 377 to 425 mg/l. Nitrates varied from 9.2 to 12.2 mg/l, while sulphates varied from 52.5 to 75.6 mg/l.

Ground Water

The pH of the water samples collected ranged from 7.36 to 7.62 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 434 to 786 mg/l in all samples. Total hardness varied between 160 to 280 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 50-55m bgl. The maximum depth proposed out of proposed projects is 25m below ground level.

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 seven open well and six bore wells.

The average water level in the open well is varies from = 9.5m to 12.4m bgl

The water level in the bore well is varies from = 56.9 to 59.8m bgl

Based on the water level contour map of the open well and bore well the water flow direction in the particular region is towards North side.

The water level in the area is above 56m 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: WINTER SEASON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

S.NO	LABEL	LONGITUDE	LATITUDE	Dec-24	Jan-25	Feb-25
1	OW-1	79° 45' 49.1316" E	12° 13' 09.3583" N	10.4	11.2	11.8
2	OW-2	79° 46' 03.2404" E	12° 13' 35.2653" N	10.2	11	11.6
3	OW-3	79° 45' 21.8097" E	12° 13' 21.2456" N	10.5	11.3	11.9
4	OW-4	79° 46' 25.2974" E	12° 13' 16.9412" N	9.5	10.3	10.9
5	OW-5	79° 46' 42.8846" E	12° 12' 51.7941" N	10.3	11.1	11.7
6	OW-6	79° 46' 12.8902" E	12° 13' 52.3640" N	11	11.8	12.4
7	OW-7	79° 45' 37.6471" E	12° 12' 48.5080" N	10.5	11.3	11.9
8	OW-8	79° 46' 08.2802" E	12° 12' 28.6930" N	10.8	11.6	12.2

Source: Onsite monitoring data

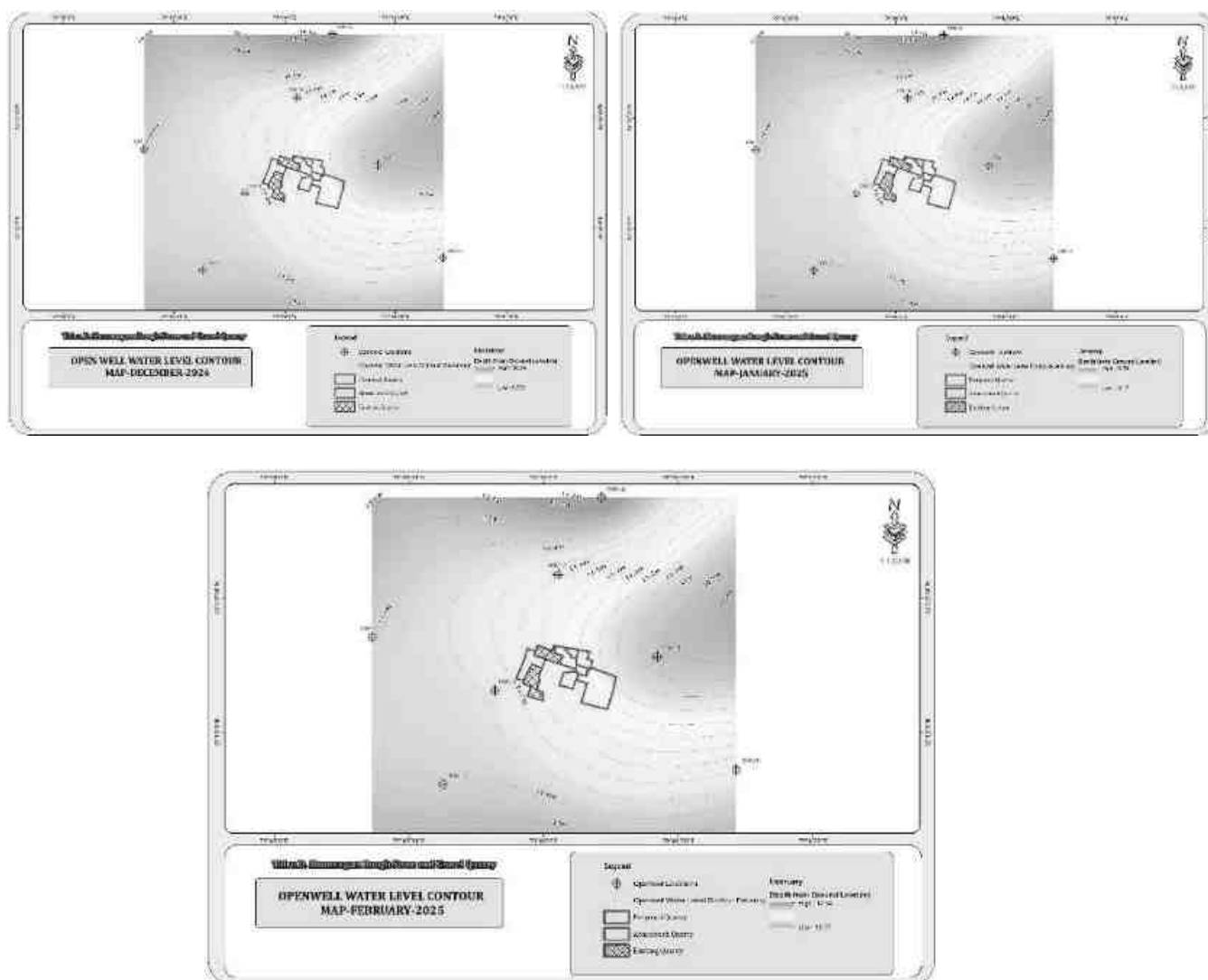
FIGURE 3.7: OPEN WELL CONTOUR MAP Dec 2024- Feb 2025

TABLE 3.12: WINTER SEASON WATER LEVEL OF BOREWELLS 1 KM RADIUS

S.NO	LABEL	LONGITUDE	LATITUDE	Dec-24	Jan-25	Feb-25
1	BW1	79° 45' 46.5179" E	12° 13' 23.5052" N	56.9	57.5	58.1
2	BW2	79° 45' 21.7288" E	12° 13' 24.4024" N	57.2	57.8	58.4
3	BW3	79° 45' 55.0347" E	12° 13' 42.1939" N	58	58.6	59.2
4	BW4	79° 46' 07.9599" E	12° 13' 52.2769" N	57.3	57.9	58.5
5	BW5	79° 46' 26.6767" E	12° 13' 12.0325" N	58.6	59.2	59.8
6	BW6	79° 46' 51.0892" E	12° 12' 44.9301" N	57.7	58.3	58.9
7	BW7	79° 45' 38.1139" E	12° 12' 40.6333" N	57.6	58.2	58.8

Source: Onsite monitoring data

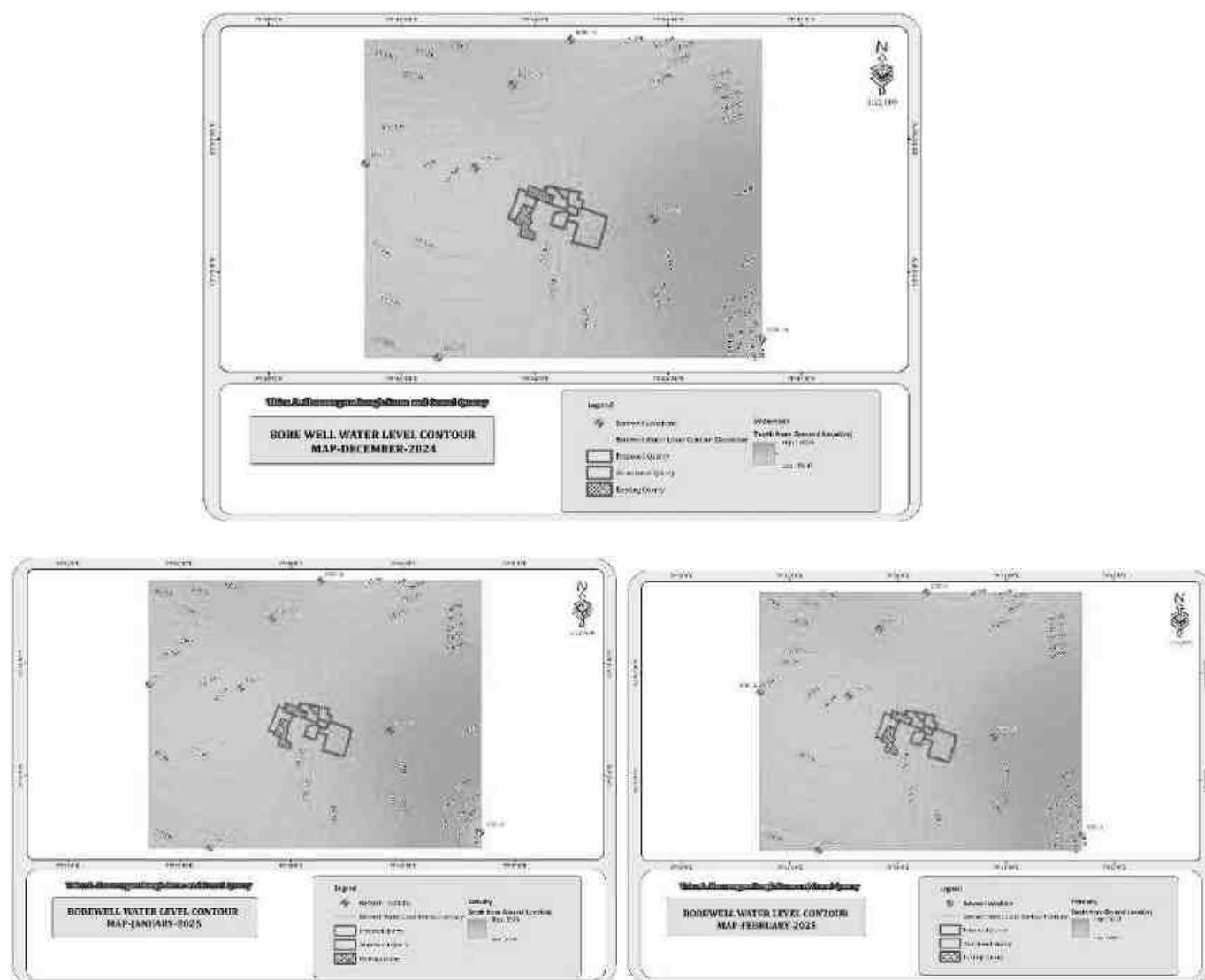
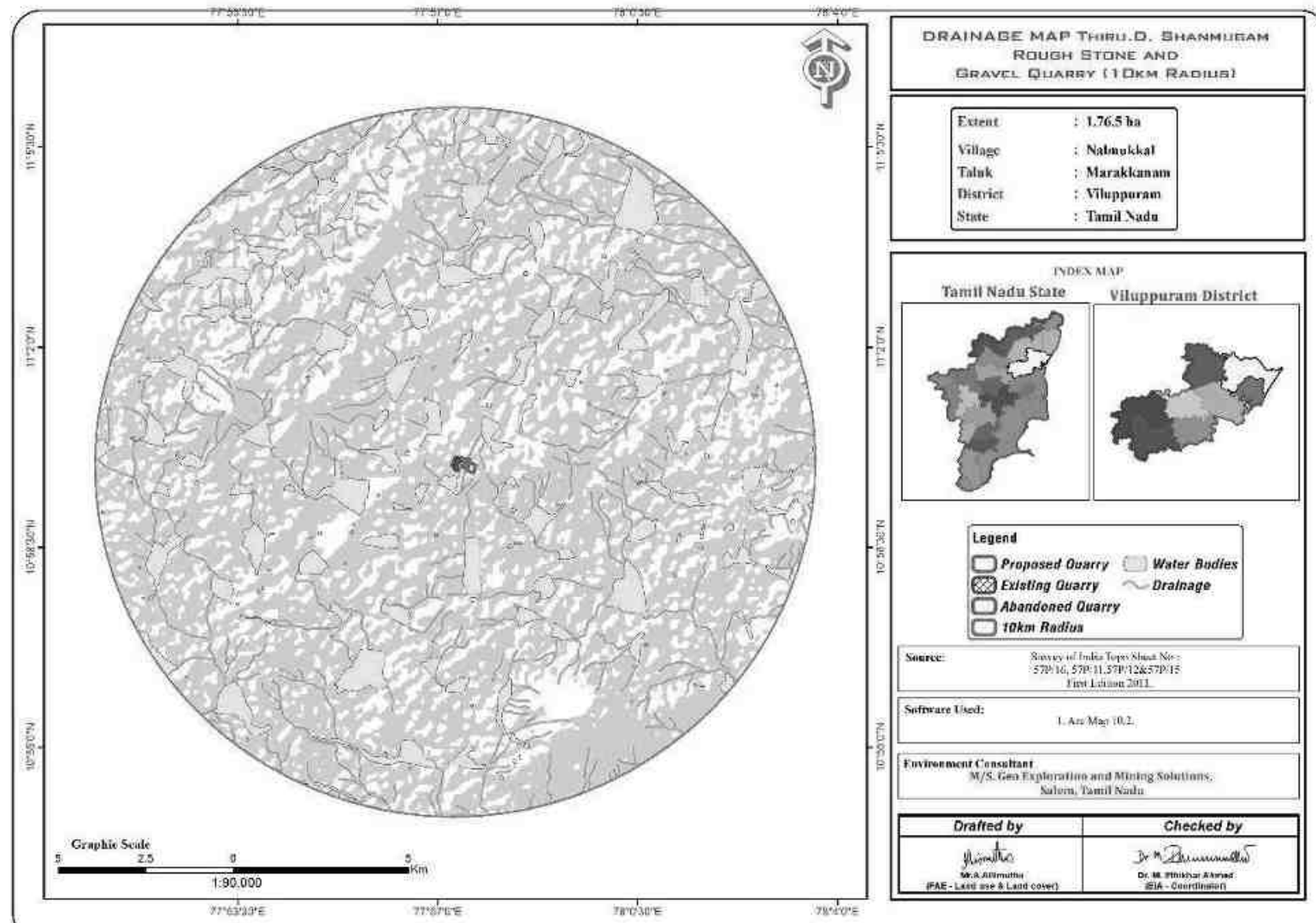
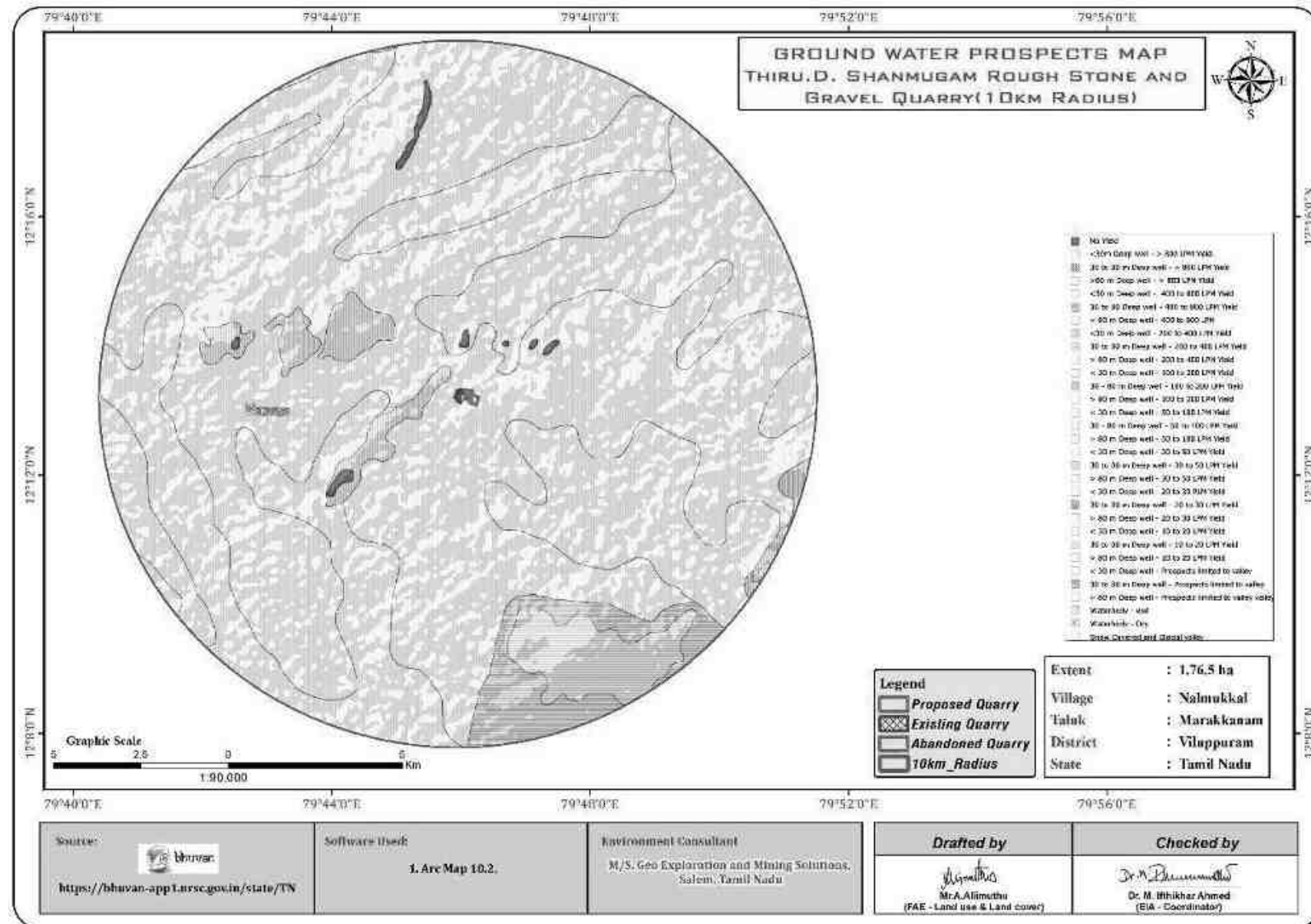
FIGURE 3.8: BOREWELL CONTOUR MAP – Dec 2024 to Feb 2025

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

Remarks: it is inferred that the area is dendritic to sub dendritic pattern

FIGURE 3.10: GROUND WATER PROSPECT MAP

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.

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

ΔV = potential difference between receiving electrodes

G = Geometric Factor.

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

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

ρ_r = Resistivity of Rocks

ρ_w = Resistivity of water in pores of rock

F = Formation Factor

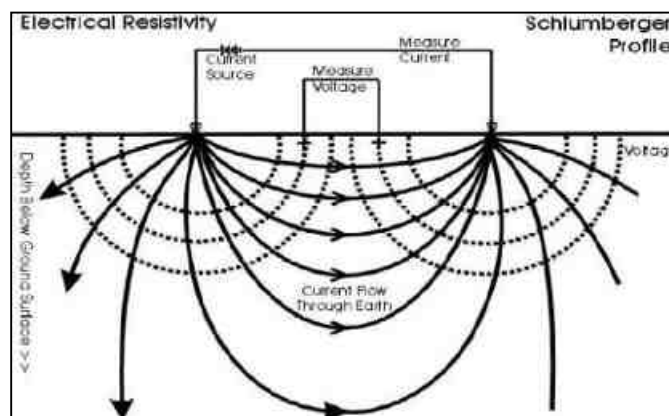
ϕ = Fractional pore volume

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 56m. The maximum depth proposed out of proposed projects 32m 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 reaches maximum of 45m and the water table is not intersected, 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.

3.7 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

- This city has a tropical climate. In winter, there is much less rainfall in Villupuram than in summer. This climate is considered to be Aw according to the Köppen-Geiger climate classification. The average annual temperature is 28.0 °C | 82.4 °F in Villupuram. The annual rainfall is 1040 mm | 40.9 inch.
- The location Villupuram is located in a temperate zone, making it difficult to categorize the seasons. The most opportune time to visit are January, February, March, December.
- The driest month is February, with 11 mm | 0.4 inch of rainfall. With an average of 208 mm | 8.2 inch, the most precipitation falls in October.
- The warmest month of the year is May, with an average temperature of 31.9 °C | 89.4 °F. January has the lowest average temperature of the year. It is 24.0 °C | 75.2 °F.

<https://en.climate-data.org/asia/india/tamil-nadu/villupuram-34141/>

Rainfall

TABLE 3.13: RAINFALL DATA

Actual Rainfall in mm					Normal Rainfall in mm
2017	2018	2019	2020	2021	
1066.9	727.5	906.3	1137.7	1935.2	985

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

TABLE 3.14: METEOROLOGICAL DATA RECORDED AT SITE

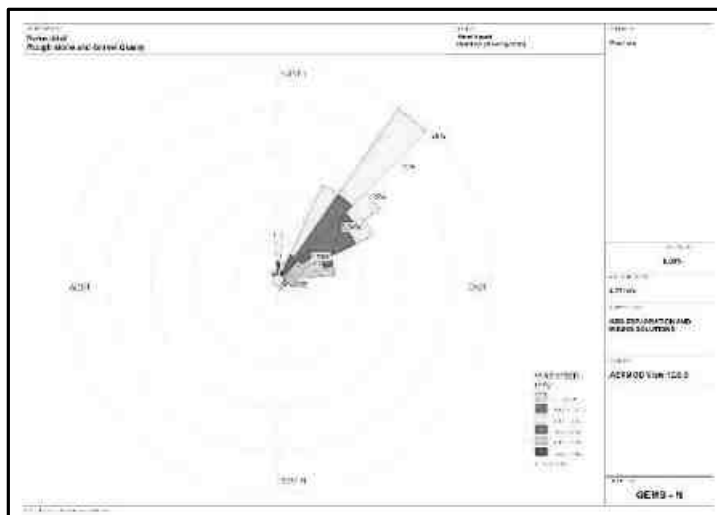
S. No	Parameters		Dec-2024	Jan-2025	Feb 2025
1	Temperature (°C)	Max	27.25	25.85	27.37
		Min	23.75	24.3	24.65
		Avg.	25.5	25.07	26.01
2	Relative Humidity (%)	Avg.	84.78	78.07	77.28
3	Wind Speed (m/s)	Max	7.75	6.97	6.74
		Min	2.63	3.37	2.13
		Avg.	5.19	5.17	4.43
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind direction		ENE,NE	NE,NNE	ENE,E

Source: On-site monitoring/sampling by EHS 360 lab in association with GEMS

Correlation between Secondary and Primary Data

The average rain fall over the period of five years is 985mm. The meteorological data collected at the site is almost similar to that of secondary data collected from IMD Villupuram. A comparison of site data generated during the three months with that of IMD, Villupuram. Wind rose diagram of the study site is depicted in Figure. 3.13 Predominant downwind direction of the area during study season is -South East to North East.

FIGURE 3.11: WINDROSE DIAGRAM



In the abstract of collected data wind rose were drawn on presented in figure No.3.14 during the monitoring period in the study area

1. Predominant winds were from ENE, E, NE
2. Wind velocity readings were recorded between 0.50 to 8.80m/s
3. Calm conditions prevail of about 0.00 % of the monitoring period
4. Temperature readings ranging from 25.07 to 26.01 °C
5. Relative humidity ranging from 77.28 to 84.78 %
6. The monitoring was carried out continuously for three months. (Oct- Dec 2024)

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
SO2	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NOx	IS-5182 Part II (Jacob & Hochheiser modified method)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by EHS 360 lab & 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 ($\mu\text{g}/\text{m}^3$)	Annual Avg.* 24 hours**	50.0 80.0	20.0 80.0
2	Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$)	Annual Avg. 24 hours	40.0 80.0	30.0 80.0
3	Particulate matter (size less than $10\mu\text{m}$) PM10 ($\mu\text{g}/\text{m}^3$)	Annual Avg. 24 hours	60.0 100.0	60.0 100.0
4	Particulate matter (size less than $2.5\mu\text{m}$) PM2.5 ($\mu\text{g}/\text{m}^3$)	Annual Avg. 24 hours	40.0 60.0	40.0 60.0

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

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

** 24 hourly / 8 hourly or 1 hourly monitored 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 Dec 2024 – Feb 2025. The baseline data of ambient air has been generated for PM10, PM2.5, 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 $3 \pm 0.5\text{m}$ 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 3.15 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	12°13'18.63"N 79°45'56.49"E
2	AAQ-2	Core Zone	Project Area	12°13'12.21"N 79°45'54.80"E
3	AAQ-3	Near Existing Quarry	170m SE	12°13'7.62"N 79°45'59.62"E
4	AAQ-4	Eappakkam	5.5km NW	12°16'10.95"N 79°45'2.08"E
5	AAQ-5	Olagapuram	6km SE	12° 9'58.56"N 79°46'26.33"E
6	AAQ-6	Perumukkal	4km SW	12°12'40.47"N 79°43'39.22"E
7	AAQ-7	Vadanerkunam	6.2km NE	12°14'31.31"N 79°49'12.87"E

Source: On-site monitoring/sampling by EHS 360 lab in association with GEMS.

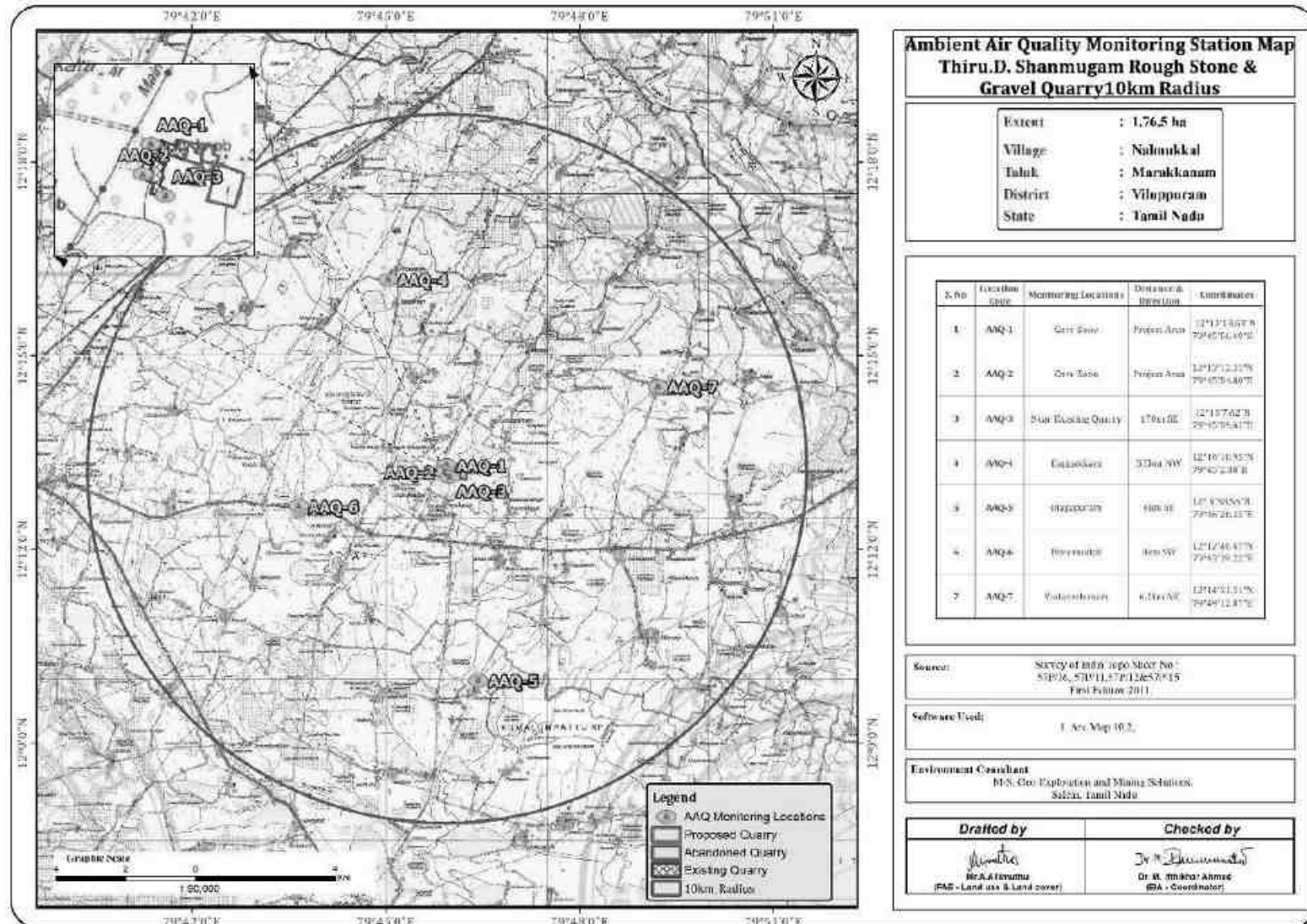
FIGURE 3.12: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

TABLE 3.18: SUMMARY OF AAQ 1 to AAQ 7

PM₁₀	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Arithmetic Mean	44.7	42.8	40.7	40.8	43.1	42.9	43.4
Minimum	40.1	39.4	34.9	35.9	39.9	40.2	40.2
Maximum	46.7	45.5	44.4	43.7	47.2	46.2	47.2
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0
PM_{2.5}	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7
Arithmetic Mean	24.2	22.1	22.6	21.6	22.4	21.9	22.0
Minimum	21.0	20.2	20.3	18.9	20.0	20.3	20.5
Maximum	26.8	23.5	25.4	23.5	24.5	23.5	23.7
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	6.6	6.9	6.4	6.6	7.0	6.7	6.8
Minimum	5.0	5.0	5.0	5.0	5.6	5.2	3.3
Maximum	8.4	8.9	7.5	8.8	8.3	7.8	8.8
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	22.9	23.3	23.3	22.2	22.4	23.7	24.0
Minimum	20.9	21.0	21.3	20.3	20.2	21.2	20.5
Maximum	25.0	25.6	25.7	25.6	25.5	26.2	26.8
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

1	Parameter	PM ₁₀	PM _{2.5}	SO ₂	NO ₂
2	No. of Observations	260	260	260	260
3	10 th Percentile Value	40.0	20.6	5.4	21.2
4	20 th Percentile Value	41.1	21.3	6.0	21.5
5	30 th Percentile Value	41.5	21.4	6.2	22.2
6	40 th Percentile Value	41.9	21.6	6.4	22.5
7	50 th Percentile Value	42.5	21.9	6.7	23.2
8	60 th Percentile Value	42.7	22.4	7.0	23.6
9	70 th Percentile Value	43.3	22.9	7.2	23.9
10	80 th Percentile Value	43.9	23.5	7.5	24.5
11	90 th Percentile Value	45.5	23.6	8.0	25.5
12	95 th Percentile Value	46.3	23.9	8.3	25.6
13	98 th Percentile Value	47.2	24.6	8.8	26.2
14	Arithmetic Mean	43.3	22.5	7.1	23.6
15	Geometric Mean	43.2	22.5	7.0	23.6
16	Standard Deviation	2.3	1.3	1.0	1.7
17	Minimum	40.0	20.6	5.4	21.2
18	Maximum	47.2	24.6	8.8	26.2
19	NAAQ Norms*	100.0	60.0	80.0	80.0
	% Values exceeding Norms*	0.0	0.0	0.0	0.0

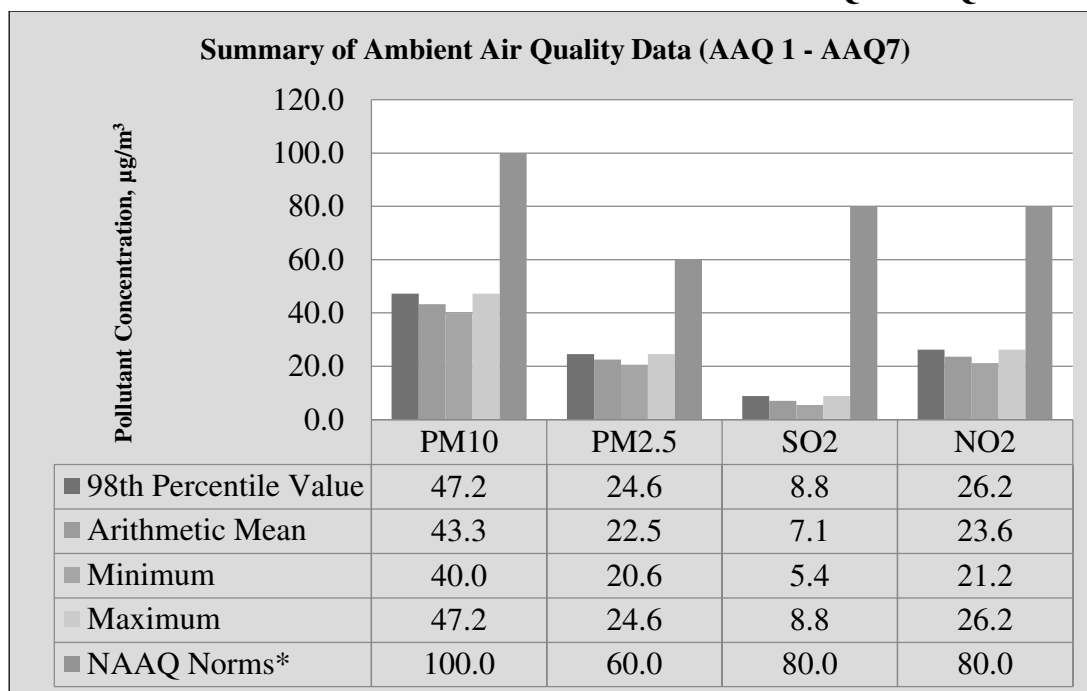
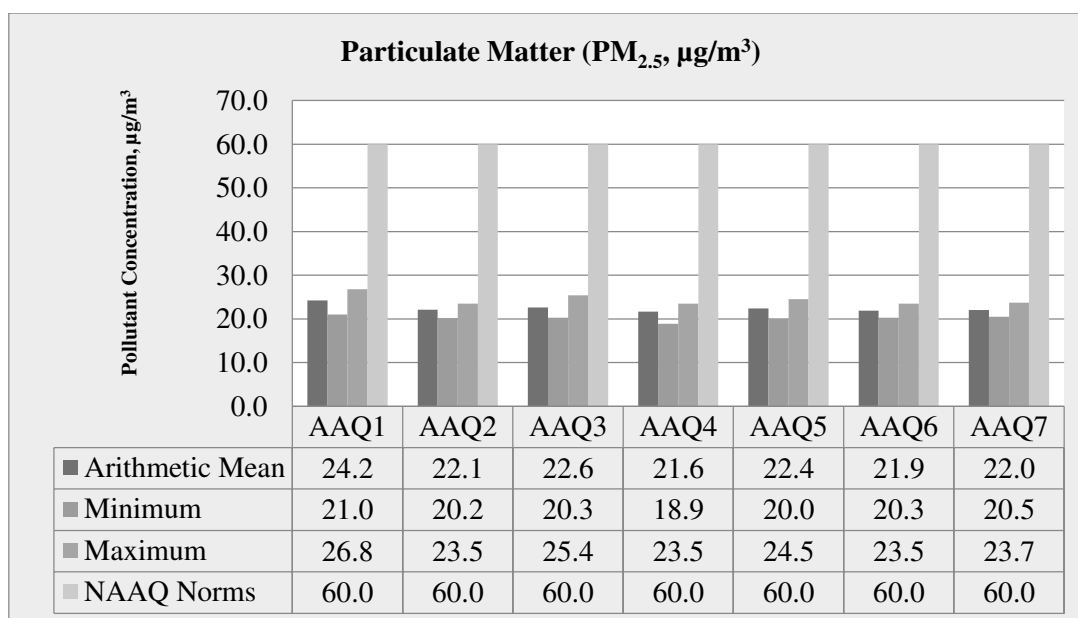
FIGURE 3.13: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ7**FIGURE 3.14: BAR DIAGRAM OF PARTICULATE MATTER PM_{2.5}**

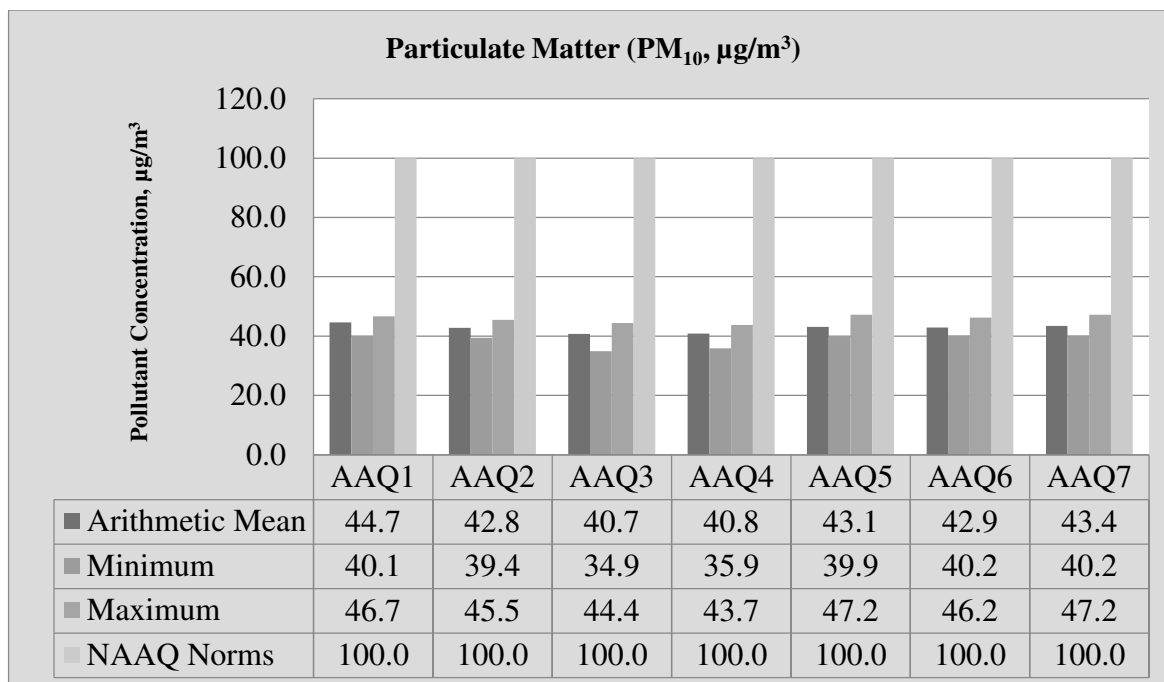
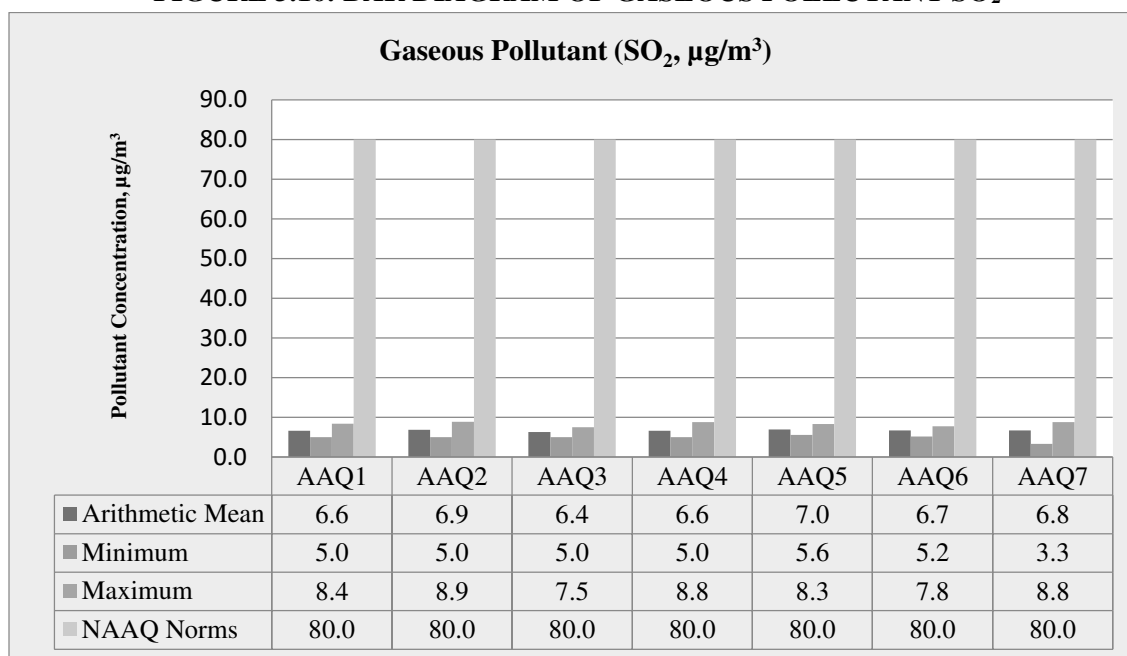
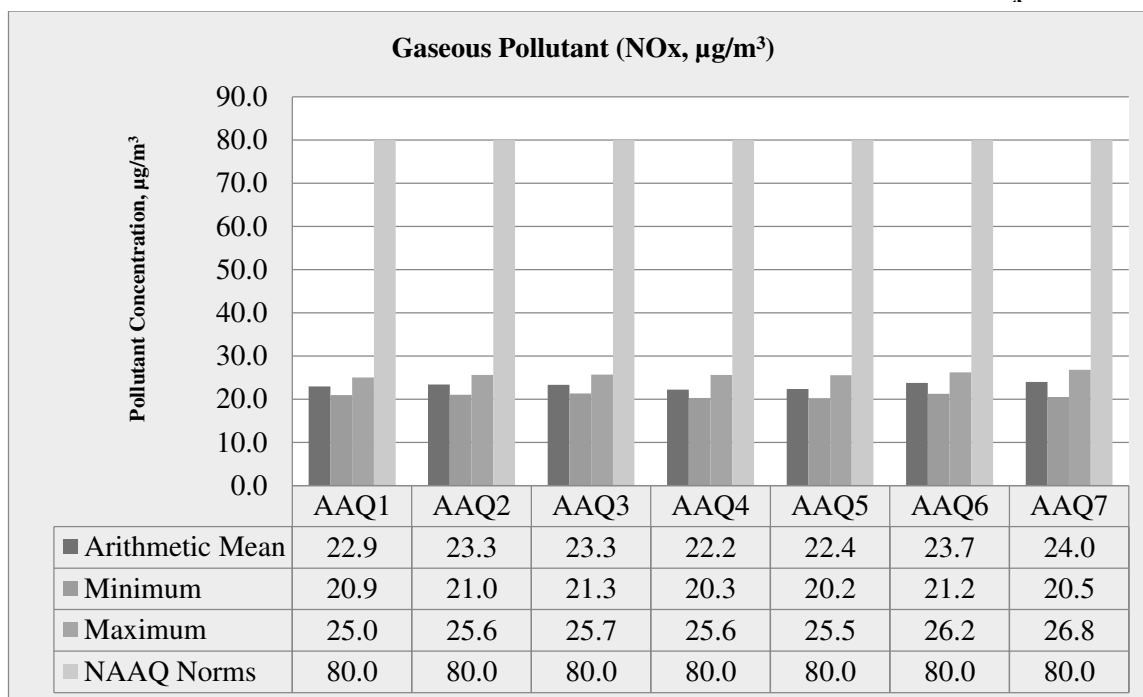
FIGURE 3.15: BAR DIAGRAM OF PARTICULATE MATTER PM₁₀**FIGURE 3.16: BAR DIAGRAM OF GASEOUS POLLUTANT SO₂**

FIGURE 3.17: BAR DIAGRAM OF GASEOUS POLLUTANT NO_x

3.3.6 Interpretations & Conclusion

As per monitoring data, PM₁₀ ranges from 40.7 µg/m³ to 44.7 µg/m³, PM_{2.5} data ranges from 21.6 µg/m³ to 24.2 µg/m³, SO₂ ranges from 6.4 µg/m³ to 7.0 µg/m³ and NO₂ data ranges from 22.2 µg/m³ to 24.0 µg/m³. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

3.8 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 3.20: DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	N1	Core Zone	Project Area	12°13'12.12"N 79°45'55.20"E
2	N2	Core Zone	Project Area	12°13'17.74"N 79°45'57.80"E
3	N3	Near Existing Quarry	170m SE	12°13'7.83"N 79°45'57.76"E
4	N4	Eappakkam	5.5km NW	12°16'11.12"N 79°45'3.49"E
5	N5	Olagapuram	6km SE	12° 9'59.00"N 79°46'26.06"E
6	N6	Perumukkal	4km SW	12°12'40.92"N 79°43'39.30"E
7	N7	Vadanerkunam	6.2km NE	12°14'31.84"N 79°49'9.99"E

Source: On-site monitoring/sampling by EHS 360 lab 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 L_{eq} , is used. Equivalent sound level, ' L_{eq} ', 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,

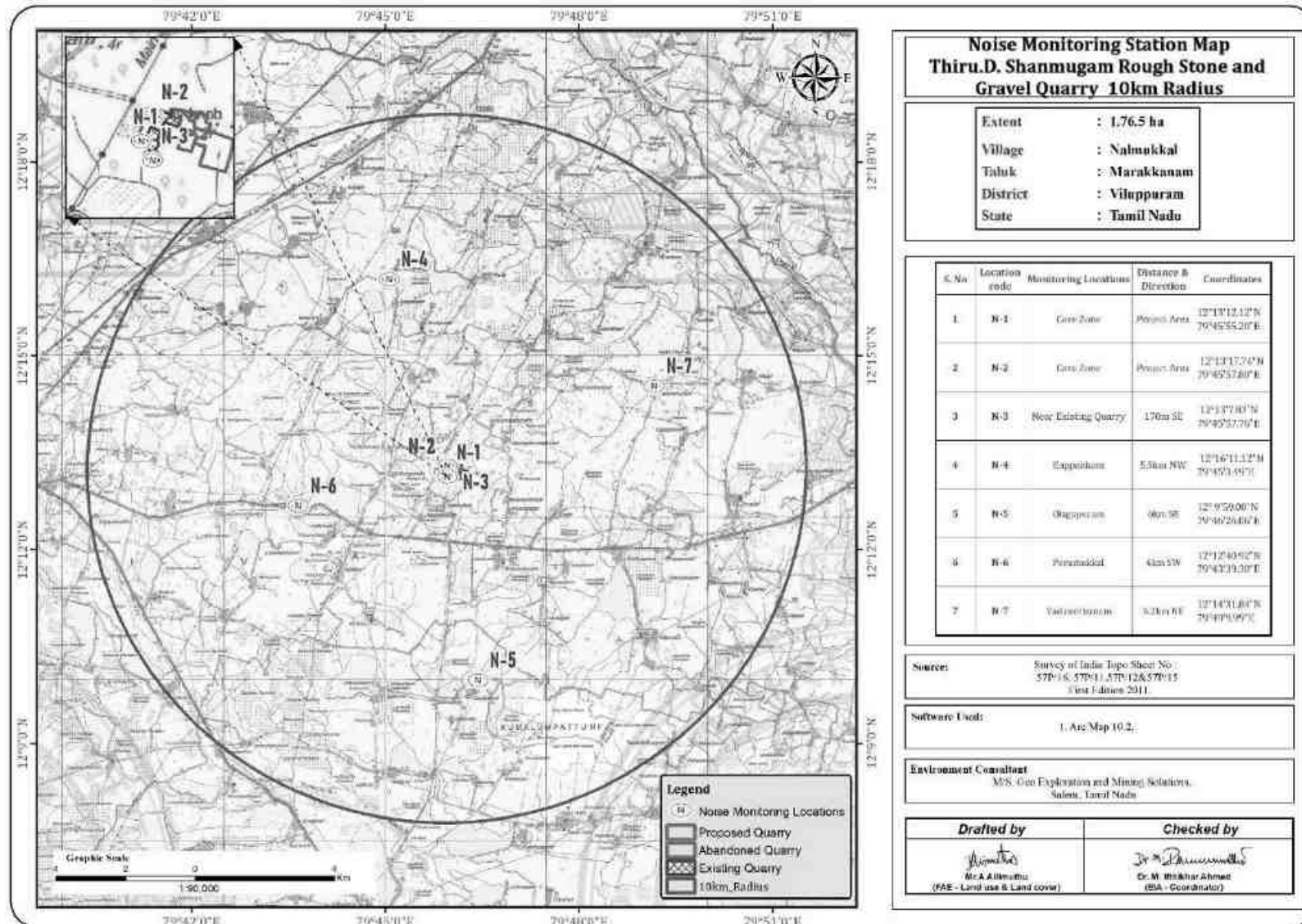
$$L_{eq} = 10 \log L / T \sum (10L_n/10)$$

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 3.18: 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 3.32.

Day time: 6:00 hours to 22.00 hours.

Night time: 22:00 hours to 6.00 hours.

TABLE 3.21: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core Zone	38.1	39.2	Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)
2	Core Zone	34.2	34.1	
3	Near Existing Quarry	38.8	34.8	
4	Eappakkam	39.9	36.4	
5	Olagapuram	46.1	37.2	Residential Day Time- 55 dB (A) Night Time- 45 dB (A)
6	Perumukkal	40.0	34.3	
7	Vadanerkunam	45.1	43.7	

Source: On-site monitoring/sampling by EHS 360 lab Private Limited in association with GEMS

FIGURE 3.19: DAY TIME NOISE LEVELS IN CORE AND BUFFER ZONE

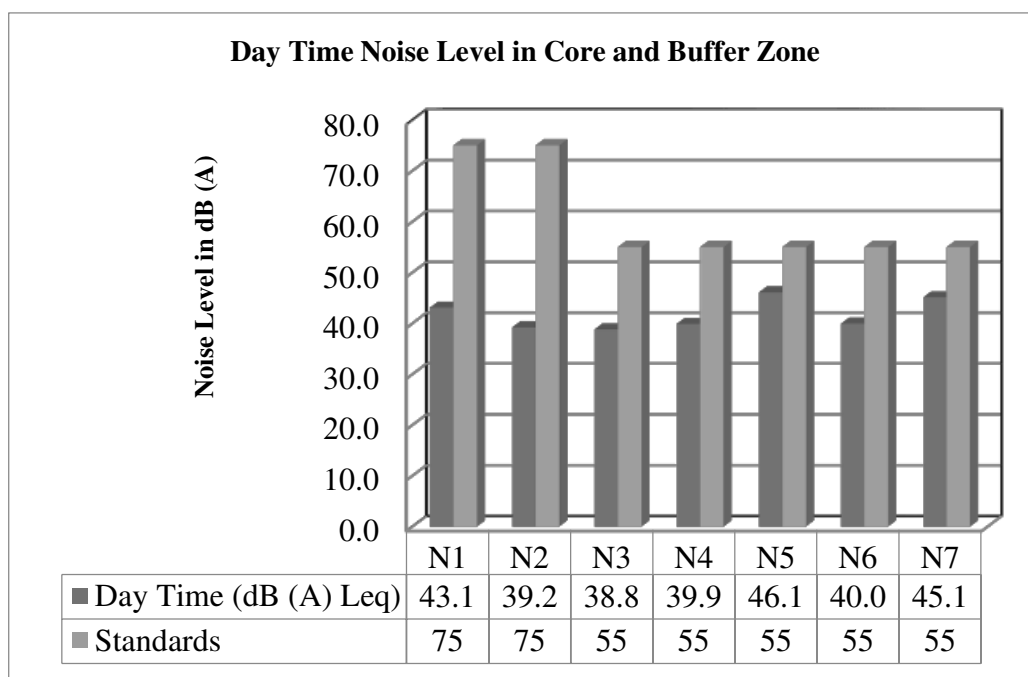
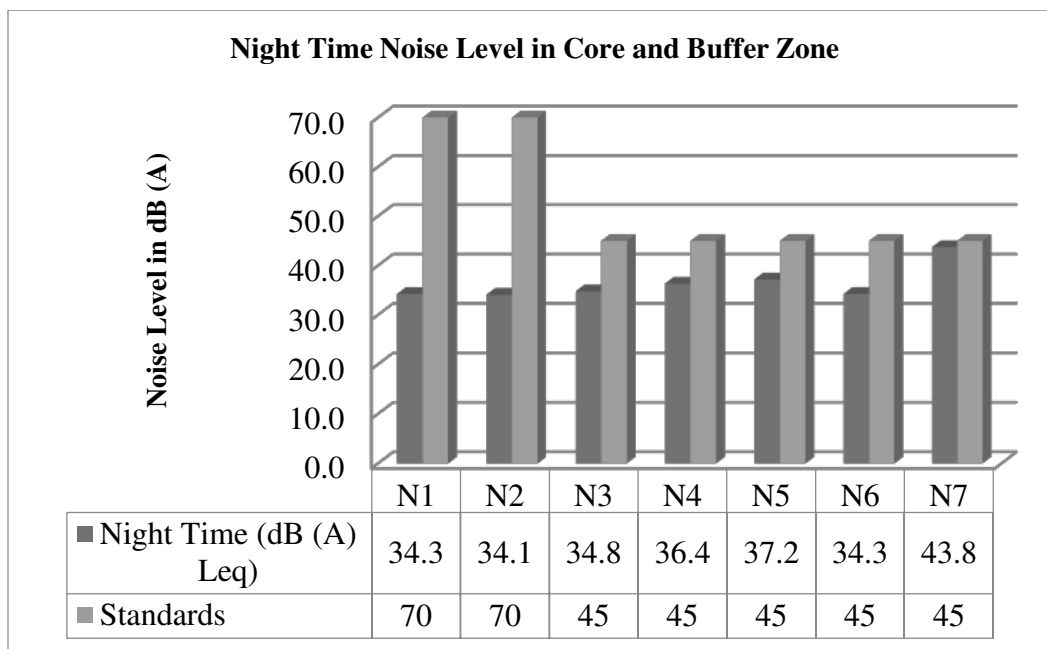


FIGURE 3.20: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE**3.4.4 Interpretation & Conclusion:**

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 39.2 to 43.1 dB (A) Leq and during night time were from 34.1 to 34.3 dB (A) Leq. Noise levels recorded in buffer zone during day time were from 38.8 to 46.1 dB (A) Leq and during night time were from 34.3 to 43.8 dB (A) Leq. Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.5 Ecological Environment

Tamil Nadu is the southernmost state of the Indian peninsula, spread over 1,30, 058 Sq.Km. Among the southern states, Tamil Nadu contains the maximum number of 9 of the total of 16 major forest types recognized in India by Champion and Seth. Within the major types 48 Subtypes in the zone in which they are present.

Villupuram district evolved from the erstwhile composite South Arcot District and commenced functioning from the 30th September 1993 as 23rd district of Tamil Nadu State with its Head Quarters as Villupuram and the Villupuram District is bounded by Bay of Bengal and the Union Territory of Puducherry in the East and Kancheepuram and Thiruvannamalai District in the North, Cuddalore District in the South and Dharmapuri and Salem District in the West and it covers with a total area of 7194 sq.km. This district lies between 11° 38' 25" and 12° 20' 44" of north latitude and 78° 15' 00" and 79° 42' 55" of east longitude.

Forest Types in Villupuram District Circle

Gingee and Kalrayan Hills are the two hills in the district. Forest areas in the district constitutes about 9.9% of the total area of the district which spread in the areas bordering Salem, Dharmapuri and Thiruvannamalai Districts with divisions of reserve forest, interface forest and social forest. Teak wood rose wood and sandal wood trees are found to be grown in the hills. In the Kalrayan hills and Gingee areas some medicinal plants are grown. In the social forest areas, trees raised are mainly for firewood and paper making. Babul, Eucalyptus and Casuarine are found to be grown in the district. In some pockets of the district, cashew is also grown.

3.5.0. Introductions

Ecology is a branch of science which dealing the relations and interactions between organisms and their environment. An ecological survey of the study area was conducted, particularly with reference to listing of species and assessment of the existing baseline ecological conditions in the study area. The main objective of biological study is to collect the baseline data regarding flora and fauna in the study area. Data has been collected through extensive survey of the area with reference to flora and fauna. Information is also collected from different sources i.e. government departments such as District Forest Office, Government of Tamil Nadu. On the basis of onsite observations as well as forest department records the checklist of flora and fauna was prepared.

3.5.1. Scope of work

Scope of work for this study includes identification of ecologically sensitive receptors, based on literature survey, field investigations and their mitigation with conservation action plan. The study was carried out in the core as well as buffer zone of the Proposed Rough stone and Gravel quarry. The study was carried out systematically and scientifically using primary and secondary data in order to bring out factual information on the ecological conditions of the mine site and 10 km radius study area.

The study involved assessment of general habitat type, vegetation pattern, preparation of inventory of flora and fauna of terrestrial ecosystem within 10 km radius from the boundary of Proposed Mine site. Biological assessment of the site was done to identify ecologically sensitive areas and whether there are any rare, endangered, endemic or threatened (REET) species of flora & fauna in the core area as well its buffer zone to be impacted. The study also designed to suggest suitable mitigation measures if necessary for protection of wildlife habitats and conservation of REET species if any.

3.5.2. Study area Ecology

In this project, the total area of Cluster with in 10km radius from the periphery of this quarry is reported as **9.06.5 Ha with 4 No. of quarries**. In such Cluster situation a common Ecology and Biodiversity study for the entire cluster of quarries is enough to capture all the possible externalities. The Core mining area is less vegetation whereas in buffer zone agricultural land is dominated. The following methods were applied during the baseline study of flora, fauna and diversity assessment.

3.5.3. Objectives of Biological Studies

The present study was undertaken with the following objectives:

- a) To study the likely impact of the proposed mining project on the local biodiversity and to suggest mitigation measure, if required, for vulnerable biota.
- b) To assess the nature and distribution of vegetation (Terrestrial and Aquatic) in and around the mining activity.
- c) Detail of flora and fauna, Endemic, Rare, Endangered and Threatened (RET Species) separately for core and buffer area based on such primary field survey and clearly indicating the Schedule of fauna present. In case of any schedule- 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.
- d) Devise management & conservation measures for biodiversity.

3.5.4. Methodology of Sampling

The present study was carried out in given steps

- I. Field survey was conducted by visual encounter survey for flora present within the 10 km radius study area of proposed mine site.
 - II. After surveying the core and buffer areas, a detailed floral inventory has been compiled. List of all plants of the study area was prepared and their habitats were recorded.
 - III. Verification of Rare, Endangered and Threatened Flora species from IUCN Red Data Book.
- a) **Site selection criteria:** The core study area is located at Village: Nalmukkal, Taluk: Marakkanam, District: Villupuram, Tamil Nadu. The buffer study area comprises of 10 km radius from the proposed Rough stone and Gravel quarry area.
 - b) Selection of sampling locations was made with reference to topography, land use, vegetation pattern, etc. The observations were taken on natural vegetation, roadside plantation and nonforest area (agricultural field, in plain areas, Village wasteland, etc.) for quantitative representation of different species.

A methodology of Sampling Flora and fauna studies were carried out during the summer season to assess the list of terrestrial plant and animal species that occur in the core area and the buffer area up to 10 km radius from the project site. No damage is created to flora and fauna during the sampling.

In order to provide representative ecological status for the study area, the 10-km buffer zone has been divided into four quartiles for biodiversity sampling, i.e., NE (Quartile-1), NW (Quartile-2) SW (Quartile-3) and SE (Quartile-4). Each of the quartiles have been examined for representative flora on randomly sampled quadrats for trees (25x25-m), shrubs (10x10-m) and herbs (2x2-m) depending upon prevailing geographical conditions and bio-diversity aspects of study area.

3.5.6. Phyto-sociological Survey method

Phyto-sociological parameters, viz., Abundance, Density, Frequency (%) were measured. A total of 10 quadrats were laid down randomly within core area and 40 quadrats were laid down within four quartiles randomly (10/quartile) in buffer area. In core area 10 quadrats were laid randomly to enumerated trees, shrubs, and herbs as per the Following formulae used for calculating the frequency (%), abundance and density of the floral species encountered in the 10 quadrats studied.

3.5.7. Quadrats method

Quadrats of 25 × 25-m were laid down randomly within core and 5-km buffer area; each quadrat was laid to assess the trees (>5 cm GBH) and one, 10 × 10-m sub-quadrat nested within the quadrat for shrubs. The quadrats were laid randomly to cover the area to maximize the sampling efforts and minimize the species homogeneity, such as small stream area, trees in agricultural bunds, tank bunds, farm forestry plantations, wildlife areas, natural forest area, avenue plantations, house backyards, etc. In each quadrat individuals belonging to tree (25 × 25-m) and shrub (10 × 10-m) were recorded separately and have been identified on the field.

3.5.8 Flora in Core Zone

Taxonomically a total of 17 species belonging to 16 families have been recorded from the core mining lease area. It is exhibit plain topography. Based on habitat classification of the enumerated plants the majority of species were Herbs 7 (41%) followed by Trees 5 (29%), Shrubs 3 (18%) and Climbers 2 (12%). Details of flora with the scientific name were mentioned in Table No. 3.29. The result of core zone of flora studies shows that Fabaceae are the main dominating species in the study area it mentioned in Table No.3.29 and the details of diversity of flora family's pattern are given in Fig No.3.21. No species found as threatened category (Table No. 3.29).

3.6 Flora in Buffer Zone

Similar type of environment also in buffer area but with more flora diversity compare than core zone area because nearby agriculture land was found to dominate mostly in all the directions. Majority of the flat landscape around project unit is occupied by agriculture fields. It contains a total of 63 species belonging to 34 families have been recorded from the buffer zone. The floral (63) varieties among them Thirty three Trees 33 (52%) Twelve Herbs 12 (19%) and Eleven Herbs 11 (18%) and Climbers Seven 7 (11%) were identified. The result of buffer zone of flora studies shows that Solanaceae, Fabaceae and Arecaceae are the main dominating species in the study area it mentioned in Table No.3.30.

There is no Rare, Endangered and Threatened Flora species in mining area and their surrounding area. Details of flora with the scientific name were mentioned in Table No.3.30. The diversity of flora families is given in Fig No.3.21.

An ecological survey of the study area was conducted particularly with reference to the listing of species and assessment of the existing baseline ecological (terrestrial) condition in the study area. There is no Forest land, National Parks, Eco sensitive areas, Wild life sanctuaries within the radius of 10km.

3.6.1 Forest Types in Villupuram District

Gingee and Kalrayan Hills are the two hills in the district. Forest areas in the district constitutes about 9.9% of the total area of the district which spread in the areas bordering Salem, Dharmapuri and Thiruvannamalai Districts with divisions of reserve forest, interface forest and social forest. Teak wood rose wood and sandal wood trees are found to be grown in the hills. In the Kalrayan hills and Gingee areas some medicinal plants are grown. In the social forest areas, trees raised are mainly for firewood and paper making. Babul, Eucalyptus and Casuarina are found to be grown in the district. In some pockets of the district, cashew is also grown.

3.6.2 Study area Ecology

The Core area is dry land with scanty vegetation whereas in buffer zone agricultural land is dominated. The following methods were applied during the baseline study of flora, fauna and diversity assessment.

3.6.3 Methodology of Sampling

A methodology of Sampling Flora and fauna studies were carried out during the winter season (December 2020 to February 2021) to assess the list of terrestrial plant and animal species that occur in the core area and the buffer area. No damage is created to flora and fauna during the sampling. None of the specimens were collected as voucher specimens and for the herbarium. It is basically done through field observations only. The study of flora is conducted as per the guidelines of the Ministry of Environment Forest and Climate Change (MoEF & CC) and

Botanical Survey of India (BSI). The study involved in the collection of primary data by conducting a survey in the field, examination of floral and faunal records in previously published reports and records. Analysis of the information is the view of the possible alteration in the environment of the project site. For the survey of fauna, both direct and indirect observation methods were used.

3.6.4 Flora

3.6.4.1 Survey Methodology

The present study on the floral assessment for the existing project activity is based on extensive field survey of the area. The plant species were identified with the help of plant taxonomy manual, literatures and Botanical Survey of India website (efloraindia.nic.in). In addition besides the collection of plant species, information was also collected with vernacular names of plant species made by local inhabitants.

3.6.4.2 Flora in Core Zone (Within Cluster)

a. Species composition, Distribution and Conservation status

The types of plants are spiny and cactus species dominated throughout the core and buffer area which indicates it is typically dry and sparsely rain area. It directly affects the growth of flora in that particular area.

Baseline study showed that very low species richness (16) comprising of five trees (6), three shrub (3) and six herbs (7). Sixteen flora varieties distributed among 14 families with dominated by *Fabaceae* (2) and *Arecaceae* (2) each species. No species found as threatened category. The result of core zone of flora studies shows that *Fabaceae* and *Arecaceae* are the main dominating species in the study area. It mentioned in Table No.3.27 and the details of diversity of flora family's pattern are given in Fig No.3.22.

Table 3.22: Flora in Core Zone

Sl.No.	English Name	Vernacular Name	Scientific Name	Family Name
TREES				
1	Acacia	Karuvelai	Vachellianilotica	Fabaceae
2	Asian Palmyra palm	Panai	Borassus flabellifer	Arecaceae
3	Noni	Nuna	Morinda tinctoria	Rubiaceae
4	Neem	Vembu	Azadirachta indica	Meliaceae
5	Iron wood	Savukku	Casuarinas equisetifolia	Casuarinaceae
SHRUBS				
6	Avaram	Avarai	Sennaauriculata	Fabaceae
7	Touch-me-not	Thottalchinungi	Mimosa pudica	Mimosaceae
8	Milk Weed	Erukku	Calotropis gigantea	Apocynaceae
HERBS				
9	Tridax daisy	Veetukaayapoond	Tridax procumbens	Asteraceae
10	Indian doab	Arugampul	Cytodon dactylon	Poaceae
11	Mountain knotgrass	Poolapoond	Aerva lanata	Amaranthaceae
12	Common leucas	Thumbai	Leucasaspera	Lamiaceae
13	Large calotrops	Yanainerunjil	Pedaliu murex	Pedaliaceae
14	Yellow-fruit Nightshade	Katangkathri	Solanumxanthocarpum	Solanaceae
15	Devil's thorn	Nerunji	Tribulus terrestris	Zygophyllaceae
CLIMBER				
16	Stemmed vine	Perandai	Cissus quadrangularis	Vitaceae
17	Wild bitter	Pavarkai	Momordica charantia	Cucurbitaceae

Source: Field Study

3.6.4.3 Flora in Buffer Zone

The study area contains thirty nine (39) flora varieties among them fifteen trees (14), six shrubs (6), nine herbs (9) and five climbers (5) were identified. Thirty-nine flora varieties distributed under 21 families. The result of buffer zone of flora studies shows that *Fabaceae* (3) and *Arecaceae* (3) and *Asteraceae* (3) are the main dominating

species in the buffer zone area it mentioned in Table No.3.28 and the details of diversity of flora family's pattern for buffer zone are given in Fig No.3.22.

Table 3.23: Flora in Buffer Zone

Sl. No	Common Name/ English Name	Tamil local Name	Scientific Name	Family Name	Resource use type *(E,M,EM)
TREES					
1	Lemon	Ezhumuchai	Citrus lemon	Rutaceae	EM
2	Coconut	Tenga	Coccus nucifera	Arecaceae	E
3	Indian Tulip Tree	Poovarasam	Thespesia populnea	Malvaceae	M
4	Tamarind	Puliyamaram	Tamarindus indica	Legumes	EM
5	Guava	Koyya	Psidium guajava	Myrtaceae	M
6	Banana tree	Vazhaimaram	Musa	Musaceae	EM
7	Neem	Neem	Azadirachta indica	Meliaceae	EM
8	Castor oil plant	Amanakku	Ricinus communis	Euphorbiaceae	M
9	Black plum	Navalmaram	Sygygium cumini	Myrtaceae	EM
10	Mango	Manga	Mangifera indica	Anacardiaceae	E
11	Banyan tree	Alamaram	Ficus benghalensis	Moraceae	E
12	Indian gooseberry	Nelli	Embllica officinalis	Phyllanthaceae	EM
13	Asian Palmyra	Panai	Borassus flabellifer	Arecaceae	E
14	Henna	Marudaani	Lawsonia inermis	Lythraceae	EM
15	Noni	Nuna maram	Morinda citrifolia	Rubiaceae	M
16	Black plum	Kottainaval	Syzygiumcumini	Myrtaceae	EM
17	Indian mallow	Thuthi	Abutilon indicum	Meliaceae	M
18	Iron wood	Savaku	Casuarina equisetifolia	Casuarinaceae	E
19	Thorn mimosa	Karuvelam tree	Acacia nilotica	Mimosaceae	E
20	Jack fruit	Palamaram	Artocarpus heterophyllus	Moraceae	E
21	Chinese chaste tree	Nochi	Vitex negundo	Verbenaceae	E
22	Manilkara zapota	Sapota	Manilkara zapota	Sapotaceae	E
23	Beauty leaf	Punnai	Calophyllu inophyllum	Calophyllaceae	M
24	Algarroba	Mulla maram	Prosopis juliflora	Fabaceae	E
25	Papaya	Pappali maram	Carica papaya L	Caricaceae	EM
26	Indian mallow	Thuthi	Abutilon indicum	Malvaceae	M
27	Date palm	Pericham	Phoenix dactylifera	Arecaceae	EM
28	Acacia Nilotica	Karuvelam maram	Vachellia nilotica	Fabaceae	M
29	Teak	Tekku	Tectona grandis	Verbenaceae	E
30	Eucalyptus	Eucalyptus	Eucalyptus globules	Myrtaceae	EM
31	Custard apple	Seethapazham	Annona reticulata	Annonaceae	E
32	Bamboo	Moonghil	Bambusa bambo	Poaceae	E
33	Peepal	Arasanmaram	Ficus religiosa	Moraceae	M
SHRUBS					
34	Pipe-cane	kattamanakku	Ipomoea carnea	Convolvulaceae	NE
35	Night shade plan	Sundaika	Solanum torvum	Solanaceae	EM
36	Coatbuttons tridax- daisy	Thatha herb	Tridaxpro cumbens	Asteraceae	M
37	Touch-me-not	Thottalchinungi	Mimosa pudica	Mimosaceae	M
38	Crown flower	Eukkampu	Calotropis gigantea	Asclepiadaceae	M
39	Indian plum	Elandhai	Zizyphus mauritiana	Rhamnaceae	EM
40	Jimsonweed	Vellum mattai	Daturastramonium	Solanaceae	M
41	Big-sage	Unni	Lantana camara	Verbenaceae	M
42	Purging nut	Kattamanakku	Jatropha curcas	Euphorbiaceae	EM
43	Ceylon Date Palm	Icham	Phoenix pusilla	Arecaceae	EM
44	Large calotrops	Yanainerunjil	Pedalium murex	Pedaliaceae	M
HERBS					
45	Mountain knotgrass	Ciru pulai	Aerva lanata	Amaranthaceous	M

46	Holy basil	Thulasi	<i>Ocimum tenuiflorum</i>	Lamiaceae	M
47	Gale of the wind	Keelaneeli	<i>Phyllanthus niruri</i>	Phyllanthaceae	EM
48	<i>Tridax daisy</i>	<i>Veetukaayapoondur</i>	<i>Tridax prostrata</i>	Asteraceae	M
49	<i>Indian doab</i>	<i>Arugampul</i>	<i>Cynodon dactylon</i>	Poaceae	E
50	Red Hogweed	Mukurattai	<i>Boerhavia diffusa</i>	Nyctaginaceae	M
51	<i>Purple three-awn</i>	<i>Thodampam grass</i>	<i>Aristida purpurea</i>	Poaceae	E
52	Sickle senna	Thagarai	<i>Sennatoria</i>	Fabaceae	E
53	European black nightshade	Manathakkali	<i>Solanum nigrum</i>	Solanaceae	EM
54	Wild egg plant	Kantankattiri	<i>Solanum virginianum</i>	Solanaceae	M
55	<i>Carrot grass</i>	<i>Partiniyam</i>	<i>Parthenium hysterophorus</i>	Asteraceae	M E
56	Common leucas	Thumbai	<i>Leucas aspera</i>	Lamiaceae	M
CLIMBER					
57	Pointed gourd	Kovakkai	<i>Trichosanthes dioica</i>	Cucurbitaceae	EM
58	Wild bitter	Pavarkai	<i>Momordica charantia</i>	Cucurbitaceae	EM
59	Purple fruited Pea eggplant	Thuthuvelai	<i>Solanum trilobatum</i>	Solanaceae	EM
60	Butterfly-pea	Sangupoo	<i>Clitoria ternata</i>	Fabaceae	M
61	Bottle Guard	Sorakkai	<i>Lagenaria siceraria</i>	Cucurbitaceae	EM
62	Stemmed vine	Perandai	<i>Cissus quadrangularis</i>	Vitaceae	M
63	Wild water lemon	Sirupunaikkali	<i>Passiflora foetida</i>	Passifloraceae	M

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

3.6.4.4 List out endangered and endemic species as per the schedule of the Wildlife Protection Act 1972

1. Rare and Endangered Flora and Fauna in the Study Area

The IUCN Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. With its strong scientific base, the IUCN Red List is recognized as the most authoritative guide to the status of biological diversity. Among the enumerated flora in the study area, none of them were assigned any threat category. **In the study area there is no endangered RET Species identified.**

2. Endemic Plants of the Study Area

“Endemic”, which is defined as an area of a taxonomic unit, especially a species which has a restricted distribution or habitat, isolated from its surrounding region through geographical, ecological or temporal barriers. Among recorded plant species **none are assigned the status of endemic plant of this region.**

3. Enlistment of Vegetation in the buffer zone and core zone

Vegetation near Human Habitation Near the villages, the common species are those which are useful to the human beings. The species commonly found are *Mangifera indica*, *Madhuca longifolia*, *Tamarindus indica*, *Artocarpus heterophyllus*, *Ficus religiosa*, *Psidium guajava*, *Azadirachta indica*, etc.,

4. National Parks/Sanctuaries/Reserve Forests

As per Ministry of Environment & Forests Notifications and local forest notifications, there are no Wildlife Corridors/Bird sanctuaries/Ramsar site tiger/National parks/ Biospheres/Elephant reserves in 10-km radius from mining lease site. And there is no RF & PF in study area.

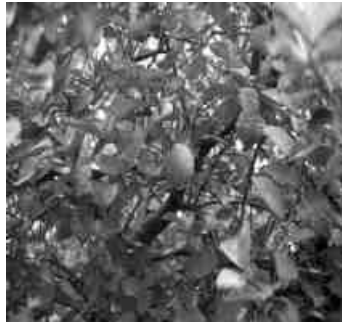
5. Biodiversity Hotspots

There are no particular Biodiversity Hotspots in Villupuram District. There is no threat to the Flora and Fauna species. (Reference – District Survey Report May 2019)

Figure 3.21: Photographs of Flora in Core and Buffer Zone



a. Azadirachta indica



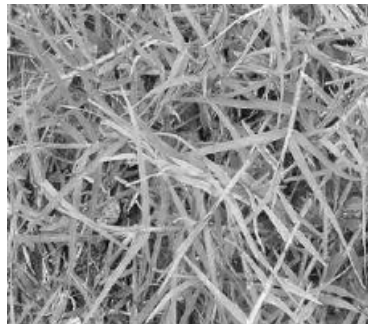
b. Citrus lemon



c. Musa paradisiaca



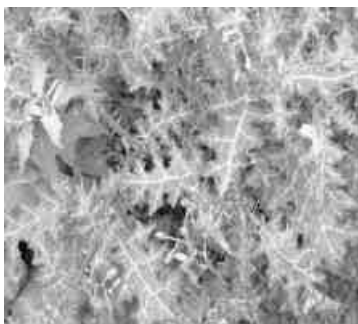
d. Coccinia grandis



e. Cynodon dactylon



f. Tridax daisy



g. Solanum virginianum



h. Mangifera indica



i. Abutilon indicum



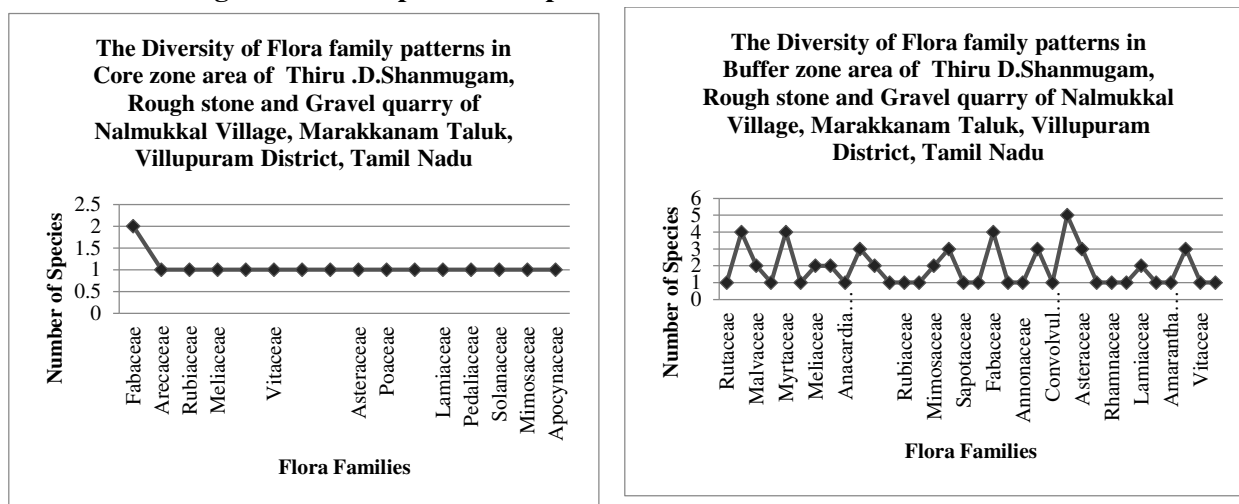
j. Coccus nucifera



k. Lagenaria siceraria



l. Cissus quadrangularis

*m. Solanumnigrum**n. Parthenium hysterophorus**o. Psidium guajava***Figure 3.22: Graphical Interpretation of Flora in Core and Buffer Zone**

3.6.5 Fauna

The faunal survey has been carried out as per the methodology cited and listed out Mammals, Birds, Reptiles, Amphibians and Butterflies. All the listed species were compared with Red Data Book and Indian Wildlife Protection Act, 1972. There are no Rare, Endangered, Threatened (RET) and Endemic species present in core area.

3.6.5.1 Fauna methodology

The assessment of fauna has been done on the bases of primary data collected from the project sites. The presence was also confirmed from the local inhabitants depending on the animal sightings and the frequency of their visits in the project area. In addition officials, local peoples were another source of information for studying the fauna of the area. Field activities are physical/active search, covering rocks, burrows, hollow inspection and location of nesting sites and habitat assessment etc., Taxonomical identification was done by the field guide book and wildlife envis data base (wiienvis.nic.in/Database/Schedule Species Database) and Zoological Survey of India (ZSI).

Table 3.24: Methodology applied during survey of fauna

Sl.No	Taxa	Method of sampling	Reference
1	Insects	Random walk, Opportunistic observations	Pollard (1977); Kunte (2000)
2	Reptiles	Visual encounter survey (Direct Search)	Daniel J.C (2002)
3	Amphibians	Visual encounter survey (Direct Search)	
4	Mammals	Tracks and Signs	Menon V (2014)

5	Aves	Random walk, Opportunistic observations	Grimmett R (2011); Ali S (1941)
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3.6.5.2 FAUNA IN CORE ZONE

a. Species composition, Distribution and Conservation status

Baseline study reported that there is very low species richness (20) comprising of Eight (8) Birds, Six (6) Insects, Four (4) Reptiles and two (2) Mammals were identified in core zone, Twenty fauna varieties distributed under 15 families. The result of core zone of fauna studies shows that Nymphalidae (4) and Agamidae (2) and Cuculidae (2) are the main dominating species in the core zone area it mentioned in Table No.3.32. The diversity of faunal family's pattern is given in Fig No. 3.23. No species is under endemic, endangered or vulnerable status.

Table 3.25: Fauna in Core Zone

Sl. No	Common Name	Family Name	Scientific Name	Schedule List WPA,1972	IUCN Class
INSECTS					
1	Plain Tiger	Nymphalidae	<i>Danaus chrysippus</i>	NL	NL
2	Common Tiger	Nymphalidae	<i>Danauus genutia</i>	NL	NL
3	Spotted joker	Nymphalidae	<i>Byblia ilithia</i>	NL	NL
4	Milkweed butterfly	Nymphalidae	<i>Danaus plexippus</i>	NL	LC
5	Red-veined darter	Libellulidae	<i>Sympetrum fonscolombii</i>	NL	LC
6	Ant	Formicidae	<i>Camponotus vicinus</i>	NL	NL
REPTILES					
7	Garden lizard	Agamidae	<i>Calotes versicolor</i>	NL	NL
8	Common house gecko	Gekkonidae	<i>Hemidactylus frenatus</i>	NL	NL
9	Indian cobra	elapid snakes	<i>Naja naja</i>	Schedule IV	LC
10	Fan-Throated Lizard	Agamidae	<i>Sitanaponticeriana</i>	NL	LC
MAMMALS					
11	Red jungle Fowl	Phasianidae	<i>Gallus gallus</i>	NL	LC
12	Cattle	Bovidae	<i>Bos taurus</i>	NL	NL
AVES					
13	Common myna	Sturnidae	<i>Acridotheres tristis</i>	NL	LC
14	Koel	Cuculidae	<i>Eudynamis scolopacea</i>	Schedule IV	LC
15	Crow Pheasant	Cuculidae	<i>Centropus sinensis</i>	Schedule IV	LC
16	House crow	Corvidae	<i>Corvus splendens</i>	NL	LC
17	Cattle egret	Ardeidae	<i>Bubulcus ibis</i>	NL	LC
18	Common cuckoo	Cuculidae	<i>Cuculus canorus</i>	NL	LC
19	Black drongo	Dicruridae	<i>Dicrurus macrocercus</i>	NL	LC
20	Red-vented Bulbul	Pycnonotidae	<i>Pycnonotus cafer</i>	Schedule IV	LC

*NL- Not listed, LC- Least concern

3.6.5.3 FAUNA IN BUFFER ZONE

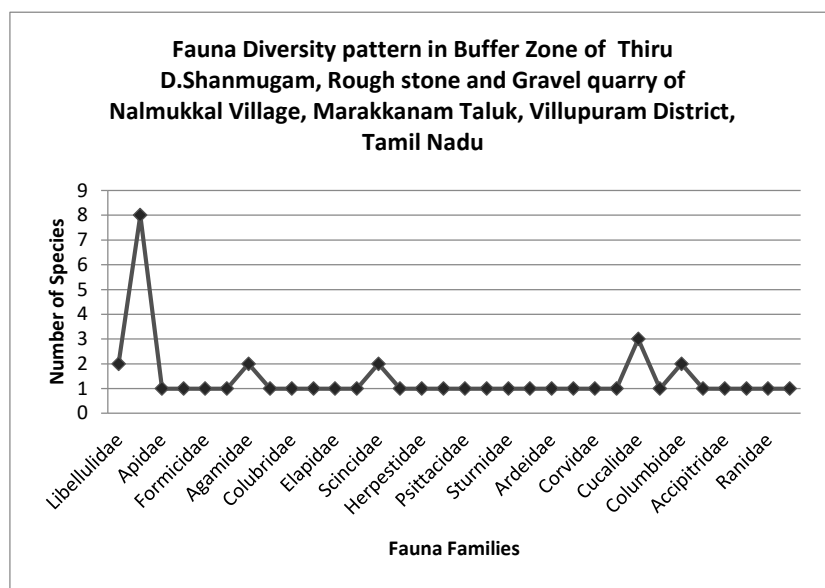
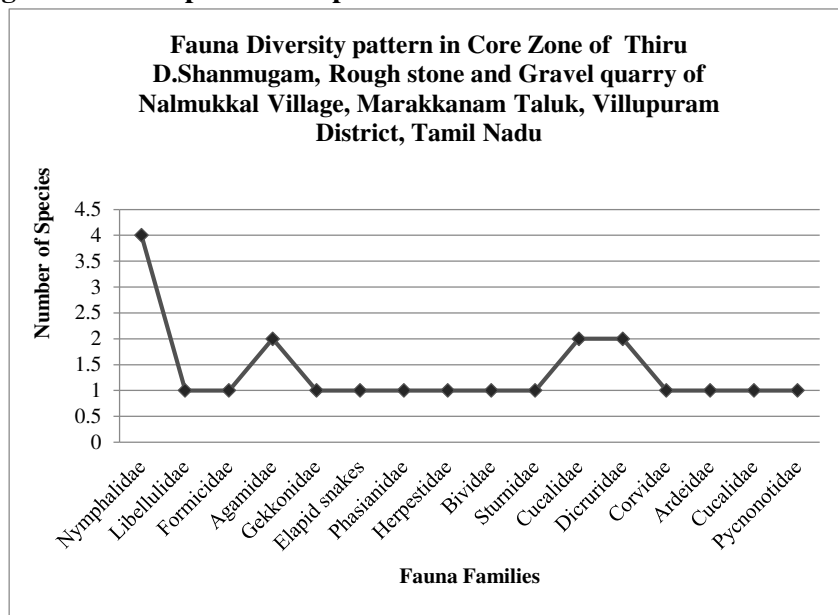
Baseline study reported that there is more species richness (32) comprising of sixteen (16) Birds, Eight (8) Insects, Five (5) Reptiles and three (3) mammals in Buffer zone, Thirty two fauna varieties distributed under 24 families. The result of Buffer zone of fauna studies shows that Nymphalidae (5) and Cuculidae (3) and Agamidae (2) are the main dominating species in the buffer zone area. There is no schedule I & II Species in study area. No species is under endemic, endangered, RET Species or vulnerable status.

Table 3.26: Fauna in Buffer Zone

Sl. No	Common Name	Family Name	Scientific Name	Schedule List WPA,1972	IUCN Class
INSECTS					
1	Red-veined darter	Libellulidae	<i>Sympetrum fonscolombii</i>	NL	LC
2	Angled castor	Nymphalidae	<i>Ariadne ariadne</i>	NL	NL
3	Spotted joker	Nymphalidae	<i>Byblia ilithia</i>	NL	NL

4	Milkweed butterfly	Nymphalidae	Danaus plexippus	NL	LC
5	Green marsh hawk	Libellulidae	Orthetrum sabina	NL	LC
6	Blue morpho	Nymphalidae	Morphomenelaus	NL	LC
7	Common Indian crow	Nymphalidae	Euploea core	Schedule IV	LC
8	Ant	Formicidae	Camponotus vicinus	NL	NL
REPTILES					
9	Common garden lizard	Agamidae	Calotes versicolor	NL	NL
10	Common house gecko	Gekkonidae	Hemidactylus frenatus	NL	NL
11	Indian cobra	Elapid snakes	Naja naja	Schedule IV	LC
12	Krait	Elapidae	Bungarus coeruleus	Schedule IV	LC
13	Fan-Throated Lizard	Agamidae	Sitana ponticeriana	NL	LC
MAMMALS					
14	Rat	Muridae	Rattus rattus	Schedule V	LC
15	Indian palm squirrel	Sciuridae	Funambulus palmarum	NL	LC
16	Rabbit	Leporidae	Oryctolagus cuniculus	NL	NT
AVES					
17	Rose-ringed parakeet	Psittacidae	Psittacula krameri	NL	LC
18	Asian green bee-eater	Meropidae	Merops orientalis	NL	LC
19	Common myna	Sturnidae	Acridothera tristis	NL	LC
20	Red-naped ibis	Threskiornithidae	Pseudibis papillosa	Schedule IV	LC
21	Cattle egret	Ardeidae	Bubulcus ibis	NL	LC
22	Japanese quail	Phasianidae	Coturnix japonica	NL	LC
23	House crow	Corvidae	Corvus splendens	NL	LC
24	White-breasted waterhen	Rallidae	Amaurornis phoenicurus	NL	LC
25	Common cuckoo	Cuculidae	Cuculus canorus	NL	LC
26	Black drongo	Dicruridae	Dicrurus macrocercus	Schedule IV	LC
27	Koel	Cuculidae	Eudynamis scolopacea	Schedule IV	LC
28	Crow Pheasant	Cuculidae	Centropus sinensis	Schedule IV	LC
29	Laughing Dove	Columbidae	Spilopelia senegalensis	NL	LC
30	House sparrow	Passeridae	Passer domestica	NL	LC
31	Eurasian Collared Dove	Columbidae	Streptopelia decaocto	NL	LC
32	Shikra	Accipitridae	Accipiter badius	NL	LC

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

Figure 3.23: Graphical Interpretation of Fauna in Core and Buffer Zone**Figure 3.24: Photographs of Fauna in Core and Buffer Zone****a. *Acridotheres tristis*****b. *Amaurornis phoenicurus*****c. *Danaus chrysippus***

*d. Calotes versicolor**e. Sitana ponticeriana**f. Corvus splendens**g. Sympetrum fonscolombii**h. Psittacula krameri**j. Danaus plexippus*

3.6.2 Interpretation& Conclusion:

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. Hence this small mining operation over short period of time will not have any significant impact on the surrounding flora and fauna.

3.7 Socio Economic Environment

There is no habitation/ village within the radius of 500 from the cluster area. 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.

3.7.1 Objectives of the Study

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

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

3.7.2 Scope of Work

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

3.7.3 Administrative Setup of Viluppuram District

Viluppuram district is divided into 9 taluks. The taluks are further divided into 22 blocks, which further divided into 1104 villages. In 2011, Viluppuram had population of 3,458,873 of which male and female were 1,740,819 and 1,718,054 respectively. In 2001 census, Viluppuram had a population of 2,960,373 of which males were 1,492,442 and remaining 1,467,931 were females. Viluppuram District population constituted 4.79 percent of total Maharashtra population. In 2001 census, this figure for Viluppuram District was at 4.74 percent of Maharashtra population.

There was change of 16.84 percent in the population compared to population as per 2001. In the previous census of India 2001, Viluppuram District recorded increase of 7.43 percent to its population compared to 1991.

3.7.4 Study area

As per the Population Census 2011, Nalmukkal is a medium size village located in Tindivanam Taluka of Viluppuram district, Tamil Nadu with total 237 families residing. The Nalmukkal village has population of 940 of which 463 are males while 477 are females as per Population Census 2011. In Nalmukkal village population of children with age 0-6 is 91 which makes up 9.68 % of total population of village. Average Sex Ratio of Nalmukkal village is 1030 which is higher than Tamil Nadu state average of 996. Child Sex Ratio for the Nalmukkal as per census is 857, lower than Tamil Nadu average of 943. Nalmukkal village has lower literacy rate compared to Tamil Nadu. In 2011, literacy rate of Nalmukkal village was 73.85 % compared to 80.09 % of Tamil Nadu. In Nalmukkal Male literacy stands at 84.06 % while female literacy rate was 64.14 %.

Table 3.27: Population Characteristics around 10km radius

Sl.No.	Village Name	No of House Holds	Total Population	Male	Female	Total SC Population	Male SC	Female SC	Total ST Population	Male ST	Female ST	Total Literate Population	Male Literate	Female Literate	Total Illiterate Population
1	Adanappattu	439	1929	998	931	662	344	318	85	37	48	1397	790	607	532
2	Agaram (Then)	110	518	263	255	485	247	238	0	0	0	361	200	161	157
3	Ambuzhukkai	134	558	294	264	124	61	63	22	15	7	377	224	153	181
4	Anganikuppam	102	403	204	199	0	0	0	0	0	0	262	151	111	141
5	Ariyankuppam	121	546	279	267	44	23	21	0	0	0	380	215	165	166
6	Aruvakkam	378	1641	825	816	838	420	418	0	0	0	1067	626	441	574
7	Athikuppam	111	448	223	225	173	88	85	0	0	0	278	173	105	170
8	Chittalambattu	631	2736	1376	1360	1060	536	524	0	0	0	1974	1072	902	762
9	Elayandapattu	294	1121	565	556	63	32	31	0	0	0	722	416	306	399
10	Erailur	2009	8826	4421	4405	560	289	271	0	0	0	6023	3077	2946	2803
11	Ganapathipattu	353	1462	727	735	327	166	161	0	0	0	964	556	408	498
12	Idaiyapattu	181	794	407	387	322	164	158	0	0	0	529	302	227	265
13	Ilvampattu	179	743	384	359	522	266	256	1	0	1	476	281	195	267
14	Iveli	348	1440	716	724	470	228	242	0	0	0	898	506	392	542
15	Kadagampattu	144	601	315	286	0	0	0	0	0	0	462	269	193	139
16	Kalingamalai	115	493	259	234	25	13	12	0	0	0	404	220	184	89
17	Kallakolathur	307	1368	709	659	785	413	372	141	72	69	840	491	349	528
18	Kanniyam	195	919	474	445	487	260	227	0	0	0	575	338	237	344
19	Karasanur	683	2862	1458	1404	539	285	254	32	16	16	1828	1084	744	1034
20	Katrambakkam	435	1887	941	946	1607	802	805	45	24	21	1094	625	469	793
21	Kayattur	396	1564	802	762	414	212	202	70	39	31	876	523	353	688
22	Kenippattu	201	943	465	478	426	212	214	0	0	0	623	340	283	320
23	Kiliyanur	1464	6334	3181	3153	3507	1782	1725	316	155	161	4111	2305	1806	2223
24	Kilkoothapakkam	300	1242	614	628	785	391	394	174	82	92	867	474	393	375
25	Kilsithamur	336	1669	832	837	1329	666	663	0	0	0	1106	617	489	563
26	Kodukkur	588	2581	1272	1309	1533	764	769	0	0	0	1662	920	742	919
27	Konamangalam	227	907	455	452	436	230	206	1	0	1	632	354	278	275
28	Kondalamkuppam	96	353	175	178	97	50	47	0	0	0	270	144	126	83
29	Kondamur	468	1915	959	956	912	466	446	0	0	0	1356	750	606	559
30	Korakkeni	218	906	489	417	361	197	164	0	0	0	594	362	232	312
31	Kunnam	401	1742	873	869	414	203	211	9	5	4	1122	630	492	620
32	Kuralur	211	816	416	400	257	131	126	9	5	4	513	307	206	303
33	Kurampalaiyam	173	723	362	361	163	81	82	0	0	0	453	250	203	270
34	Maduraipakkam	1149	4889	2436	2453	1724	868	856	13	7	6	3088	1739	1349	1801
35	Mailam	27743	117439	58872	58567	42231	21223	21008	1624	811	813	74913	42272	32641	42526
36	Mungilpattu	569	2531	1222	1309	731	336	395	0	0	0	1559	854	705	972
37	Murukkam	173	787	395	392	422	207	215	24	10	14	479	266	213	308
38	Muttarampattu	401	1730	842	888	1300	638	662	0	0	0	1109	589	520	621
39	Nemili (V)	266	1238	627	611	544	271	273	0	0	0	835	471	364	403
40	Nerkunam	320	1367	663	704	938	455	483	5	1	4	914	507	407	453
41	Olundiappattu	442	1831	884	947	598	295	303	167	88	79	1165	623	542	666

42	Ottai	407	1704	862	842	746	369	377	20	13	7	1082	630	452	622
43	Padirapuliyur	925	4202	2115	2087	2621	1312	1309	93	46	47	2566	1391	1175	1636
44	Pakkiripalayam	455	1928	971	957	16	7	9	0	0	0	1385	780	605	543
45	Parangani	773	3393	1684	1709	697	347	350	203	114	89	2205	1203	1002	1188
46	Parikkalpattu	248	1077	548	529	779	393	386	0	0	0	777	422	355	300
47	Perumbakkam	547	2184	1091	1093	9	2	7	0	0	0	1362	778	584	822
48	Pillaiyarkuppam	167	712	350	362	636	316	320	63	29	34	326	185	141	386
49	Pombur	961	3994	2004	1990	1456	743	713	121	59	62	2772	1531	1241	1222
50	Ponnampundi	132	565	289	276	154	82	72	0	0	0	375	214	161	190
51	Pulichapallam	1369	6397	3397	3000	3055	1519	1536	68	36	32	4552	2674	1878	1845
52	Radhapuram	780	3453	1735	1718	1238	601	637	0	0	0	2282	1273	1009	1171
53	Reddikuppam	65	213	105	108	0	0	0	0	0	0	160	87	73	53
54	Semangalam	863	3635	1859	1776	1361	702	659	52	26	26	2331	1348	983	1304
55	Sengamedu	234	1063	521	542	745	364	381	35	16	19	719	391	328	344
56	Seshanganur	622	2547	1281	1266	610	302	308	0	0	0	1601	913	688	946
57	Siruvai	454	1752	886	866	813	412	401	0	0	0	1079	608	471	673
58	Siruvalur (Ten)	369	1589	815	774	0	0	0	43	21	22	1105	644	461	484
59	Tailapuram	1101	4388	2206	2182	1404	726	678	16	7	9	3081	1696	1385	1307
60	Taludali	517	2257	1153	1104	301	157	144	14	8	6	1543	879	664	714
61	Tennalapakkam	352	1569	810	759	1263	663	600	0	0	0	1069	623	446	500
62	Terkunam	630	2602	1279	1323	343	174	169	71	39	32	1754	980	774	848
63	Thenkulapakkam	219	1022	523	499	529	278	251	0	0	0	713	412	301	309
64	Tirumangalam	1367	5786	2899	2887	1178	578	600	15	11	4	3954	2239	1715	1832
65	Tiruvaikkarai	738	3220	1627	1593	911	441	470	90	40	50	1904	1052	852	1316
66	Tollamur	332	1419	731	688	916	463	453	31	21	10	826	496	330	593
67	V. Pudupakkam	596	2441	1208	1233	522	247	275	0	0	0	1710	935	775	731
68	Vadanur	604	2689	1293	1396	660	309	351	0	0	0	1824	971	853	865
69	Valudavur	958	4035	2007	2028	1372	683	689	0	0	0	2656	1439	1217	1379
70	Vanur	38710	164696	83132	81564	58365	29388	28977	2513	1257	1256	109738	61518	48220	54958
71	Veliyanur	630	2903	1413	1490	1547	784	763	0	0	0	1703	914	789	1200
72	Vidur	1405	5748	2861	2887	3122	1572	1550	8	4	4	3288	1883	1405	2460

Table 3.28: Occupational Characteristics around 10km radius

S.No	Name of the villages	Total Workers Population	Male Workers	Female Workers	Total Main Workers	Main Agriculture Workers	Main Other Workers	Total Margin Workers	Margin Cultivation Workers	Margin House Hold Workers	Margin Other Workers	Non Worker Population	Non Worker Male	Non Worker Female
1	Adanappattu	1165	673	492	1145	470	208	20	4	1	15	764	325	439
2	Agaram (Then)	294	151	143	235	26	98	59	1	0	3	224	112	112
3	Ambuzhukkai	247	164	83	183	68	53	64	1	0	45	311	130	181
4	Anganikuppam	247	129	118	228	160	21	19	1	2	1	156	75	81
5	Ariyankuppam	374	183	191	346	192	66	28	1	0	0	172	96	76
6	Aruvappakkam	713	474	239	514	120	257	199	1	1	33	928	351	577
7	Athikuppam	205	143	62	190	83	68	15	0	0	1	243	80	163
8	Chittalambattu	1109	723	386	871	429	385	238	9	6	46	1627	653	974
9	Elayandapattu	674	364	310	57	3	39	617	33	17	21	447	201	246
10	Eraiyr	4033	2469	1564	3415	1586	561	618	16	25	116	4793	1952	2841
11	Ganapathipattu	837	455	382	831	476	75	6	0	1	5	625	272	353
12	Idaiyapattu	485	243	242	485	163	19	0	0	0	0	309	164	145
13	Ilvampattu	396	223	173	281	53	154	115	3	0	55	347	161	186
14	Iveli	891	483	408	766	89	52	125	5	1	19	549	233	316
15	Kaliingamalai	258	156	102	128	1	68	130	4	3	27	235	103	132
17	Kallakolathur	842	450	392	495	426	46	347	110	79	17	526	259	267
18	Kanniyam	419	262	157	220	30	107	199	0	1	7	500	212	288
19	Karasanur	1575	901	674	753	99	474	822	57	8	184	1287	557	730
20	Katrambakkam	927	529	398	892	650	213	35	0	0	7	960	412	548
21	Kayattur	689	449	240	672	375	130	17	4	0	6	875	353	522
22	Kenippattu	545	284	261	252	137	100	293	14	0	48	398	181	217
23	Kiliyanur	2818	1857	961	2545	1476	825	273	13	9	67	3516	1324	2192
24	Kilkoothapakkam	619	336	283	616	154	101	3	0	0	2	623	278	345
25	Kilsithamur	816	479	337	695	229	271	121	2	1	92	853	353	500
26	Kodukkur	1455	758	697	947	701	204	508	3	46	108	1126	514	612
27	Konamangalam	527	287	240	523	234	64	4	1	0	0	380	168	212
28	Kondalamkuppam	184	112	72	177	106	40	7	0	1	6	169	63	106
29	Kondamur	1089	601	488	561	235	257	528	5	13	70	826	358	468
30	Korakkeni	482	299	183	447	144	108	35	4	0	8	424	190	234
31	Kunnam	845	483	362	554	65	458	291	5	0	275	897	390	507
32	Kuralur	447	230	217	364	221	75	83	1	0	1	369	186	183
33	Kurampalaiyam	431	253	178	431	168	98	0	0	0	0	292	109	183
34	Maduraipakkam	2446	1457	989	2302	1811	367	144	2	2	42	2443	979	1464
35	Mailam	6118	35182	26000	45652	24014	10753	15530	1001	790	1982	56257	23690	32567
36	Mungilpattu	1641	840	801	1180	891	223	461	49	8	117	890	382	508
37	Murukkam	457	252	205	453	265	81	4	0	0	1	330	143	187
38	Muttarampattu	1030	544	486	942	763	137	88	3	0	11	700	298	402
39	Nemili (V)	677	397	280	456	134	264	221	3	20	128	561	230	331

40	Nerkunam	760	431	329	331	196	115	429	0	4	112	607	232	375
41	Olundiyappattu	1059	574	485	878	557	211	181	18	3	34	772	310	462
42	Ottai	898	488	410	687	359	235	211	13	7	53	806	374	432
43	Padirapuliur	2100	1230	870	2002	1472	164	98	5	14	64	2102	885	1217
44	Pakkiripalayam	842	583	259	330	79	208	512	17	3	75	1086	388	698
45	Parangani	1708	997	711	1057	452	466	651	4	14	157	1685	687	998
46	Parikkalpattu	530	323	207	529	284	208	1	0	0	0	547	225	322
47	Perumbakkam	1223	655	568	932	638	170	291	23	1	147	961	436	525
48	Pillaiyarkuppam	440	212	228	430	348	78	10	3	0	7	272	138	134
49	Pombur	2220	1205	1015	1541	721	154	679	14	1	12	1774	799	975
50	Ponnampundi	298	167	131	43	4	24	255	39	1	9	267	122	145
51	Pulichapallam	3034	1818	1216	2027	1262	598	1007	51	35	342	3363	1579	1784
52	Radhapuram	1524	1061	463	1121	549	439	403	25	66	119	1929	674	1255
53	Reddikuppam	79	61	18	76	20	17	3	0	0	3	134	44	90
54	Semangalam	1936	1110	826	1354	982	286	582	27	10	41	1699	749	950
55	Sengamedu	511	298	213	291	171	84	220	0	2	8	552	223	329
56	Seshanganur	1093	742	351	1064	651	335	29	2	1	9	1454	539	915
57	Siruvai	912	522	390	188	131	52	724	10	2	16	840	364	476
58	Siruvalur (Ten)	987	520	467	178	25	99	809	107	90	170	602	295	307
59	Tailapuram	2473	1352	1121	935	173	390	1538	64	24	124	1915	854	1061
60	Taludali	1158	718	440	634	63	262	524	48	9	15	1099	435	664
61	Tennalapakkam	696	452	244	616	319	195	80	9	5	18	873	358	515
62	Terkunam	1103	810	293	886	371	332	217	16	2	39	1499	469	1030
63	Thenkulapakkam	674	357	317	245	120	105	429	14	0	78	348	166	182
64	Tirumangalam	2923	1814	1109	2437	1234	818	486	10	11	85	2863	1085	1778
65	Tiruvaikkarai	1496	877	619	992	122	751	504	5	8	410	1724	750	974
66	Tollamur	637	397	240	595	367	188	42	2	2	24	782	334	448
67	V. Pudupakkam	1303	757	546	1210	612	302	93	1	3	32	1138	451	687
68	Vadanur	1366	765	601	943	207	274	423	18	9	46	1323	528	795
69	Valudavur	1729	1156	573	1304	502	612	425	10	5	79	2306	851	1455
70	Vanur	8150	49105	32404	59376	23598	23873	22133	1819	535	5518	83187	34027	49160
71	Veliyanur	1424	794	630	820	324	338	604	6	13	34	1479	619	860
72	Vidur	2790	1763	1027	2557	2122	302	233	3	1	6	2958	1098	1860

3.7.5 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 Viluppuram at a distance of 43.3km – South west)

3.7.6 Recommendation and Suggestion

- Awareness program should be conducted to make the population aware to get education and a better livelihood.
- Health care centre and ambulance facility can be provided to the population to get easy and accessible medical facilities.
- 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 youths may be employed.
- Long term and short term employments can be generated.
- Maternity facility should be made available at the place to avoid going too far off places for treatment which involves risks. Apart from that as these areas are prone to various diseases a hospital with modern facilities should be opened on a priority basis in a central place to provide better health facilities to the villagers around the project.
- While developing an Action Plan, it is very important to identify the population who falls under the marginalized and vulnerable groups. So that special attention can be given to these groups with special provisions while making action plans.

3.7.7 Conclusion

The nearby villages within 5kms radius has PHC, Anganwadi school, post office, telegram, Government and Private school, bus connectivity.

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.

3.7.8 Structure Studies up to 300m Radius

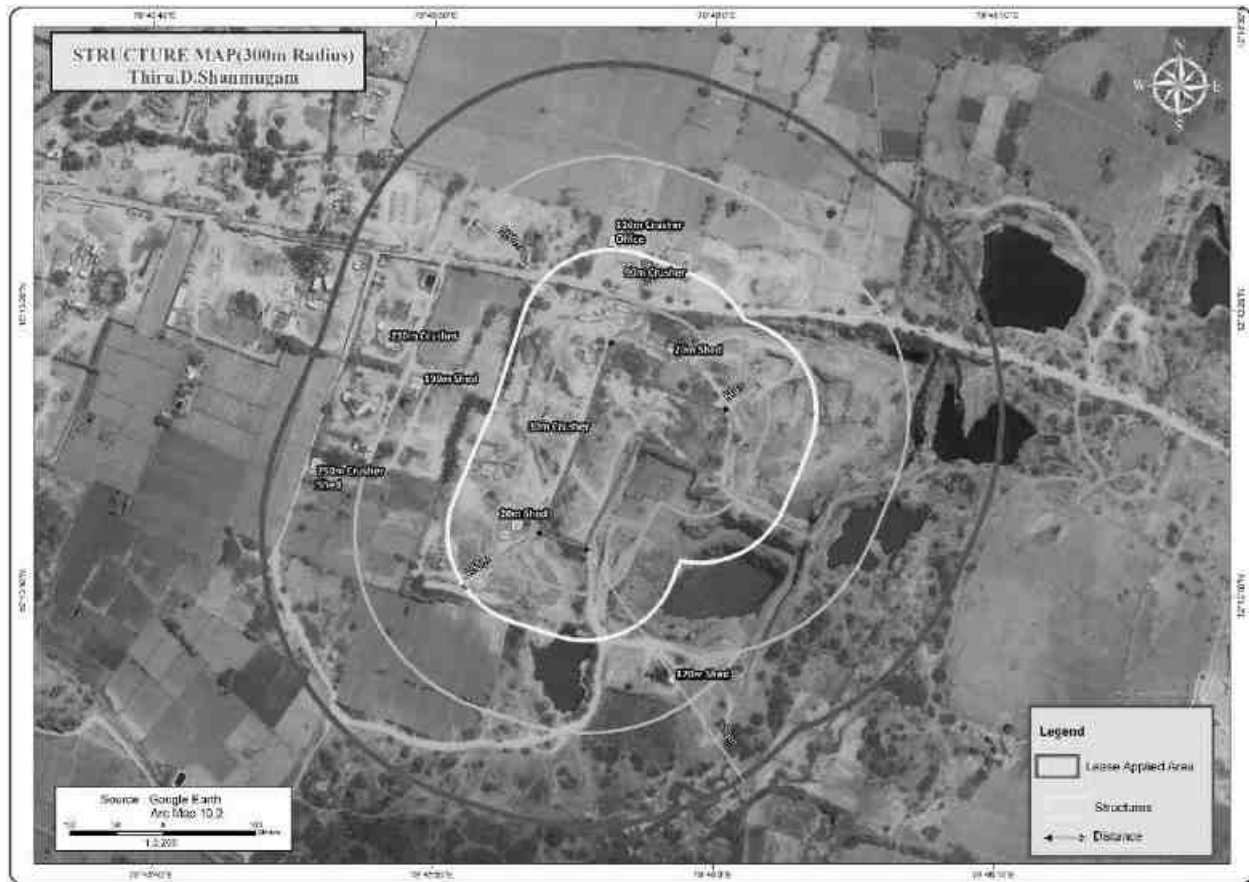


Fig.3.25 Structure map around 300m Radius

Table No 3.29 Structures details in the study area around 300m Radius

Enumeration of Structure from 0 – 300m Radius						
Structure Numbers	Distance & Direction from the project site	Structure Details and Usage Purpose	Type of Structure Structures (Kutchi/ Brick/ Cement/ RCC/ Framed Structures)	No. of Occupants	Structure belongs to owner (Yes/No)	Remarks
1	20m - North	Shed	Framed Structure	2 Nos	Yes	Used to store mines materials (Temporary use) – No Stay
3 (2 Nos)	20m - SW	Shed	Sheet & Brick Structure	4 Nos	Yes	Used to store mines materials and Labour used as a rest shelter – No Stay
4	30m - West	Crusher	Framed Structure	3 Nos	Yes	Production of M & P sand and Jelly
5	90m - North	Crusher	Framed Structure	2 Nos	Yes	Production of M & P sand and Jelly
6	110m - North	Crusher Office	Framed & RCC Structure	4 Nos	Yes	Used to store Crusher's documents – No Stay
7	170m - SE	Shed	Sheet Structure	2 Nos	Yes	Used to store mines materials – No Stay
8	190m - West	Shed	Sheet & Brick Structure	Nil	Yes	Used to store mines materials – No Stay
9	230m - West	Crusher	Framed Structure	3 Nos	Yes	Production of M & P sand and Jelly
10	250m - West	Crusher Shed	Sheet & Brick Structure	2 Nos	Yes	Used to store Crusher's materials – No Stay

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 GENERAL

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

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

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

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

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

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

4.1 LAND ENVIRONMENT:

4.1.2 Anticipated Impact

- 1.26.20 Ha of the land will be under mining since 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 cause the siltation of water course

4.1.2 Mitigation Measures

- The 1.26.20 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 benefitted by the supply of water
- About 900 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.

4.1.3 Soil Environment

4.1.4 Impact on Soil Environment

- Removal of vegetation cover
- Soil Erosion in the project site during rainy season due to quarry operation

4.1.5 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.

4.1.6 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
 - 1.6 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 settling 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.
- Waste water discharge from mine will be treated in settling tanks before using for dust suppression and tree plantation purposes.
- De-silting will be carried out before and immediately after the monsoon season.

4.3 AIR ENVIRONMENT

4.3.1. Anticipated Impact

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

4.3.1.1. Modelling of Incremental Concentration 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 9.61.

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 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 PM₁₀ was observed close to the source due to low to moderate wind speeds. Incremental value of PM₁₀ was superimposed on the base line data monitored at the proposed site to predict total GLC of PM₁₀ due to combined impacts

TABLE 4.1: ESTIMATED EMISSION RATE

PM ₁₀			
Activity	Source type	Value	Unit
Drilling	Point Source	0.065172873	g/s
Blasting	Point Source	0.000284413	g/s
Mineral Loading	Point Source	0.039395492	g/s
Haul Road	Line Source	0.002486869	g/s/m
Overall Mine	Area Source	0.048595768	g/s
SO ₂			
Activity	Source type	Value	Unit
Overall Mine	Area Source	0.000309419	g/s
NO _x			
Overall Mine	Area Source	0.000012418	g/s

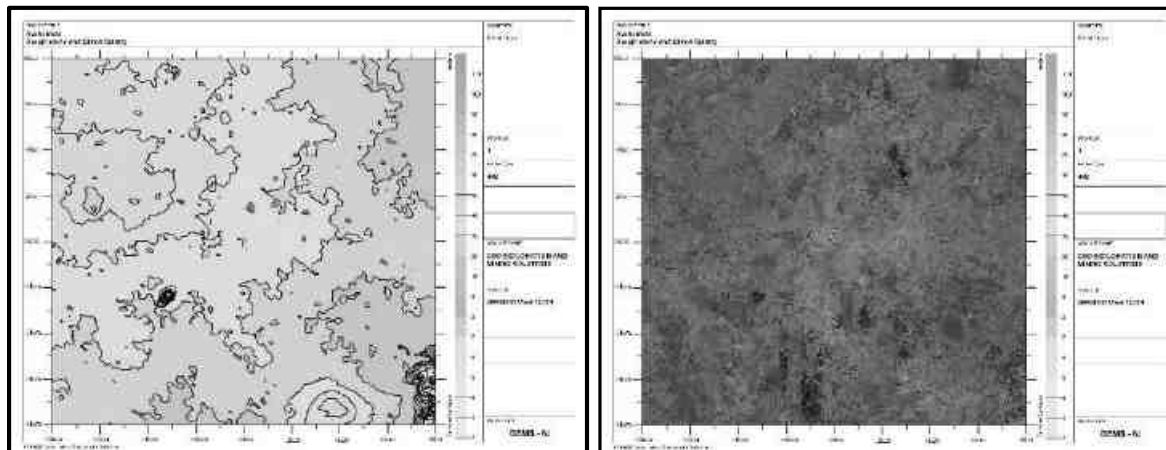
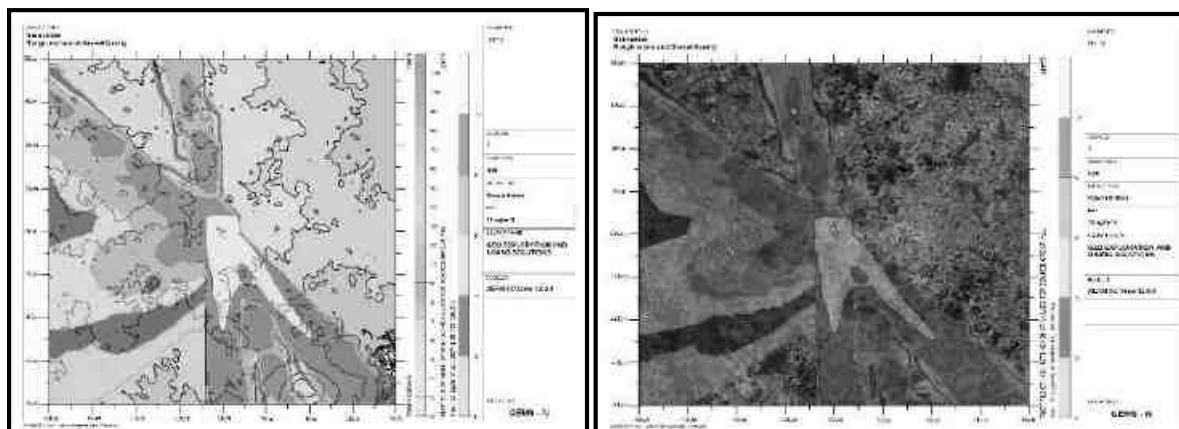
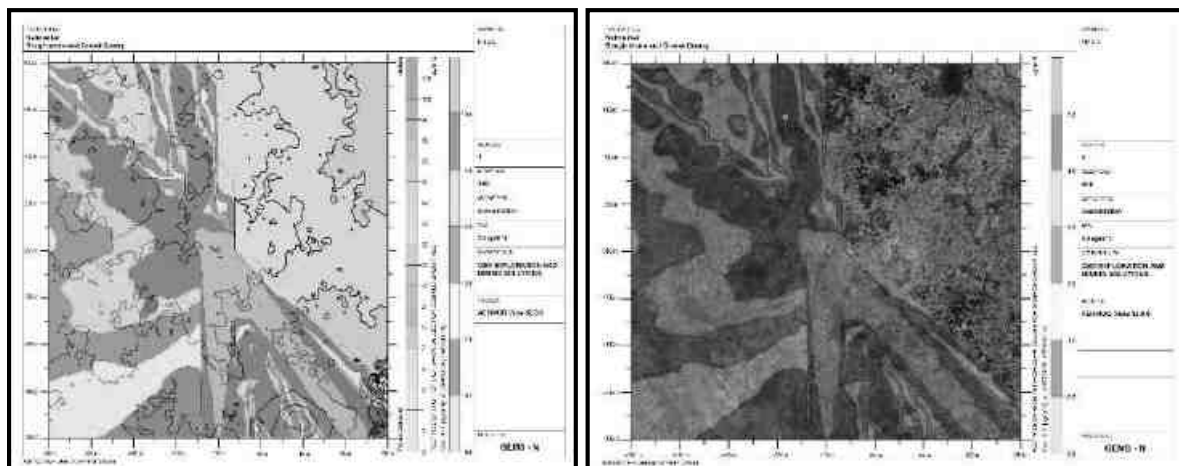
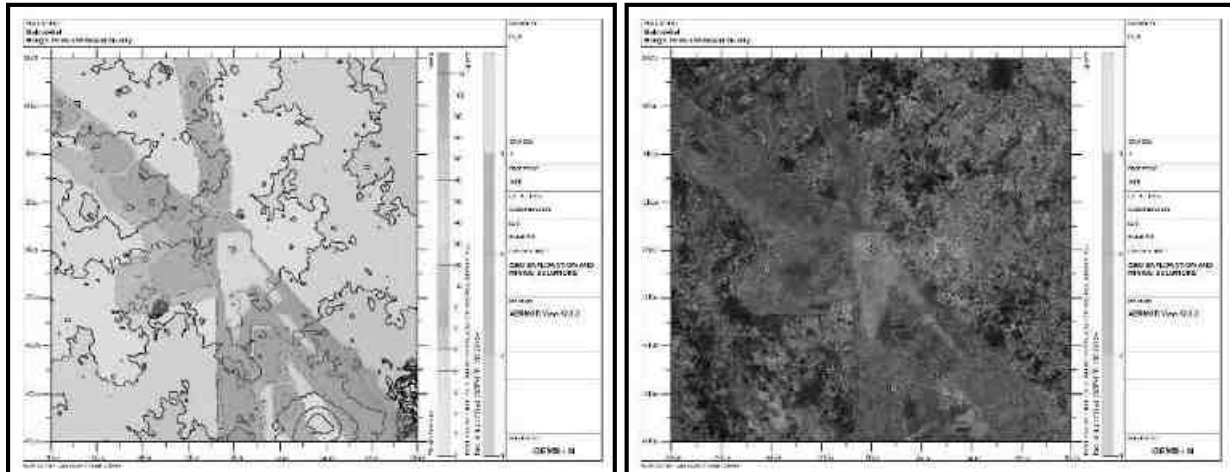
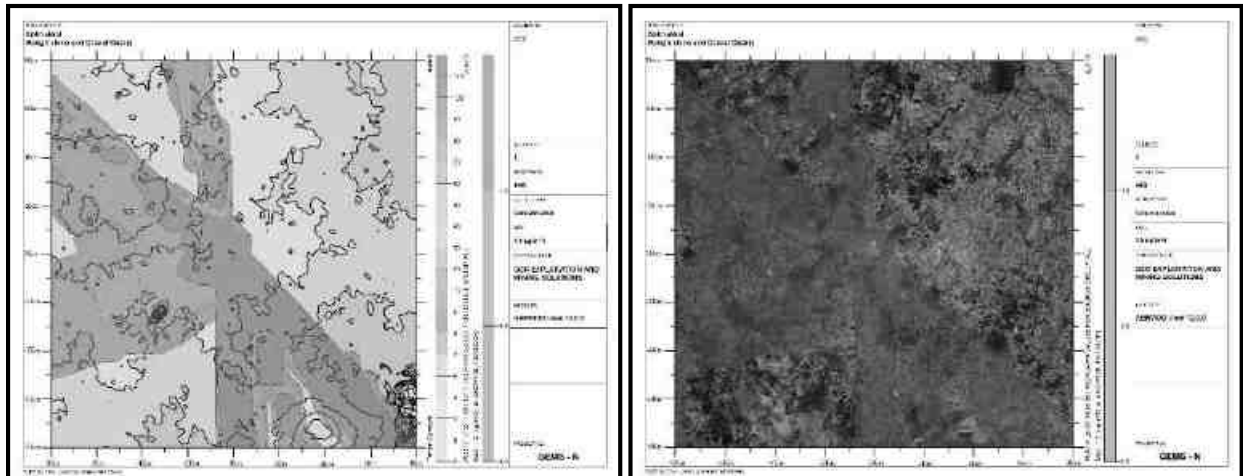
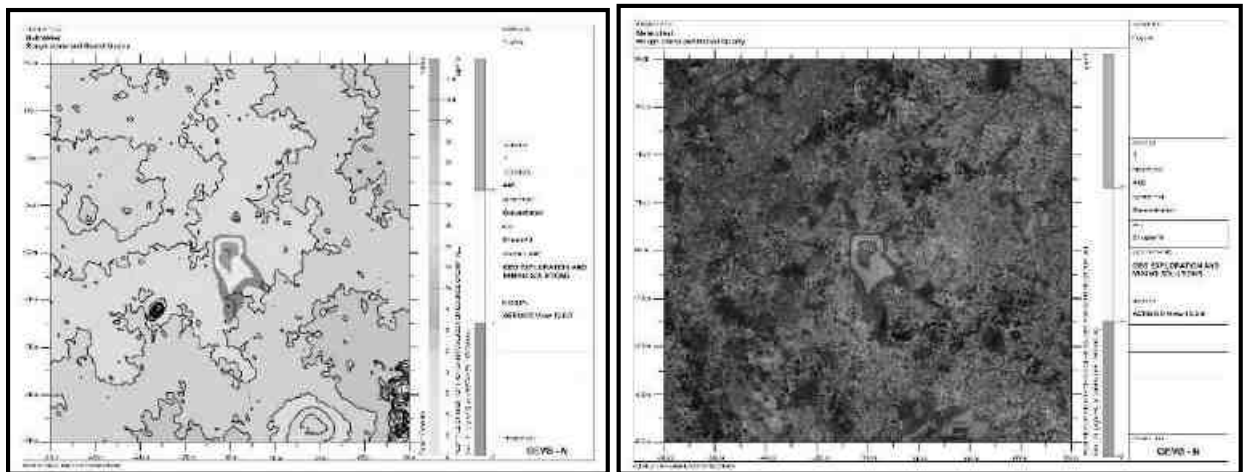
FIGURE 4.1: AERMOD TERRAIN MAP**FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM₁₀****FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF PM_{2.5}**

FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NO_x**FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF SO₂****FIGURE 4.6: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST**

4.3.2.1 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	12°13'18.63"N 79°45'56.49"E	-8	238	44.7	12.89	57.59
AAQ2	12°13'12.21"N 79°45'54.80"E	-66	-119	42.8	12.49	55.29
AAQ3	12°13'7.62"N 79°45'59.62"E	88	-264	40.7	12.19	52.89
AAQ4	12°16'10.95"N 79°45'2.08"E	-1664	5388	40.8	10.40	51.2
AAQ5	12° 9'58.56"N 79°46'26.33"E	896	-6095	43.1	8.21	51.31
AAQ6	12°12'40.47"N 79°43'39.22"E	-4179	-1099	42.9	7.00	49.9
AAQ7	12°14'31.31"N 79°49'12.87"E	5958	2319	43.4	0	43.4

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	12°13'18.63"N 79°45'56.49"E	-8	238	24.2	5.91	30.11
AAQ2	12°13'12.21"N 79°45'54.80"E	-66	-119	22.1	5.60	27.7
AAQ3	12°13'7.62"N 79°45'59.62"E	88	-264	22.6	5.22	27.82
AAQ4	12°16'10.95"N 79°45'2.08"E	-1664	5388	21.6	4.55	26.15
AAQ5	12° 9'58.56"N 79°46'26.33"E	896	-6095	22.4	3.82	26.22
AAQ6	12°12'40.47"N 79°43'39.22"E	-4179	-1099	21.9	3.61	25.51
AAQ7	12°14'31.31"N 79°49'12.87"E	5958	2319	22.0	0	22

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	12°13'18.63"N 79°45'56.49"E	-8	238	6.6	1.10	7.7
AAQ2	12°13'12.21"N 79°45'54.80"E	-66	-119	6.9	1.06	7.96
AAQ3	12°13'7.62"N 79°45'59.62"E	88	-264	6.4	1.02	7.42
AAQ4	12°16'10.95"N 79°45'2.08"E	-1664	5388	6.6	0.93	7.53
AAQ5	12° 9'58.56"N 79°46'26.33"E	896	-6095	7.0	0.76	7.76
AAQ6	12°12'40.47"N 79°43'39.22"E	-4179	-1099	6.7	0.68	7.38
AAQ7	12°14'31.31"N 79°49'12.87"E	5958	2319	6.8	0	6.8

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF NOX

Station Code	Location	X Coordinate (m)	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	AAQ1	12°13'18.63"N 79°45'56.49"E	-8	238	22.9	6.79	29.69
AAQ2	AAQ2	12°13'12.21"N 79°45'54.80"E	-66	-119	23.3	6.41	29.71
AAQ3	AAQ3	12°13'7.62"N 79°45'59.62"E	88	-264	23.3	6.20	29.5
AAQ4	AAQ4	12°16'10.95"N 79°45'2.08"E	-1664	5388	22.2	3.15	25.35
AAQ5	AAQ5	12° 9'58.56"N 79°46'26.33"E	896	-6095	22.4	1.85	24.25
AAQ6	AAQ6	12°12'40.47"N 79°43'39.22"E	-4179	-1099	23.7	1.11	24.81
AAQ7	AAQ7	12°14'31.31"N 79°49'12.87"E	5958	2319	24.0	0	24.0

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 & NOX respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.4. 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 –

- 1210 Nos of trees will be planted through this project in the lease area and village roads (Approach Road) to prevent the generation of dust due to movement of dumpers/trucks
- Green belt of adequate width will be developed around the project areas

Occupational Health –

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

4.4 NOISE ENVIRONMENT

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. These activities will not cause any problem to the inhabitants of this area because there is no human settlement 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 a speed of 1,100 ft/sec, with the first wave making an ever-increasing sphere with time. As the wave spreads the intensity of noise diminishes as the fixed amount of energy is spread over an increasing surface area of the sphere. The assumption of the model is based on point source relationship i.e., for every doubling of the distance the noise levels are decreased by 6 dB (A).

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

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

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.

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

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)	43.1	42.5	41.7	40.3	37.9	38.3	37.5
Incremental Value dB(A)	66.1	52.1	36.6	24.5	26.1	24.5	25.3
Total Predicted Noise level dB(A)	66.1	52.6	42.9	40.4	38.2	38.5	37.8

The incremental noise level is found within the range of 66.1dB (A) in Core Zone and 24.5 – 52.1 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)

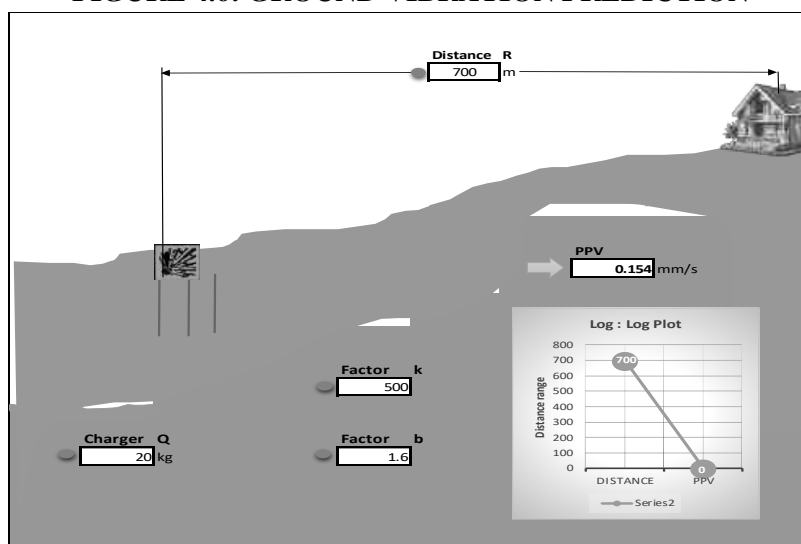
B = constant related to the rock and site (usually 1.6)

R = distance from charge (m)

TABLE 4.9: PREDICTED PPV VALUES DUE TO BLASTING

Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
20	700-SW	0.094

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 proponents ensure that the charge per blast shall be less than 20 kg and carry out blasting twice or thrice a day based on the onsite conditions under the supervision of competent person employed. However, as per statutory requirement control measures will be adopted to avoid the impacts due to ground vibrations and fly rocks due to blasting.

4.4.3.1 Mitigation Measures

- It is proposed to carry out blasting operation 20kg per round so that the vibration will be minimal
- The mining operation will be carried out without deep hole drilling, 25mm small dia 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. Impact on the Biological Environment

4.5.1. Anticipated Impact on agricultural land associated with flora

1. Dust particle settle on neighbouring agricultural land it is located about 100m on the west side. During operation and minerals are transported in approach roads.
2. 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.

4.5.2 Mitigation Measures

4.5.2.1. General Guidelines for Green Belt Development

Drone survey was covered the green belt and fencing as per the terms of references. The 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 1500-2000 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. Development of Green Belt

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.

4.5.3.4. Selection of Plant Species for Green Belt Development

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. Green belt is plantation of trees for reducing the air pollution as they absorb both gaseous and particulate pollutant, thus removing them from atmosphere. Green plants form a surface capable of absorbing air pollutants and forming sinks for pollutants. It improves the aesthetic value of local environment. Under present project, green belts have been planned with emphasis on creating biodiversity; enhance natural surroundings and mitigating pollution. Regional tree saplings in eco-friendly bags like *Pterocarpus marsupium*, *Pongamia pinnata*, *Limonia acidissima*, and *Cassia roxburghii* will be planted along the Lease boundary and avenues as well as over Non-active dumps with intervals 3m in between with the GPS Coordinates. The greenbelt development plan aims to overall improvement in the environmental conditions of the region Native plant species will be preferred.

- The species should be wind-firm and deep-rooted.
- The species should form a dense canopy.
- Fast-growing plants will be planted
- Species tolerance to air pollution like SO₂ and NO₂ should be preferred.
- Plants having large leaf area index will be considered
- Soil improving plants (Nitrogen fixing rapidly decomposable leaf litter).
- Attractive appearance with good flowering and fruit-bearing.
- Birds and insects attract tree species.
- Roadsides will be planted with local vegetation.

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

S. No	Scientific name	Tamil Name
1	<i>Aegle marmelos</i>	Vilva maram
2	<i>Albizia lebbeck</i>	Vaagai maram
3	<i>Cassia fistula</i>	Konrai tree

4	Lanea coromandelica	Othiyam
5	Limonia acidissima	Vila maram
6	Syzygium cumini	Naval maram
7	Toona ciliata	Santhana Vembu
8	Ficus hispida	Aththi maram
9	Borassus flabellifer	Panai-maram
10	Madhuca longifolia	Illupai maram

(*Source: Term of Reference-ToR)

Table No 4.2.Species suitable for abatement of noise and dust pollution

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

4.5.4. Anticipated Impact on Fauna

- Noise generation due to vehicle may affect avifauna.
- The lease area is not inhabited by any wild life, as there is no forest cover, hence there will not be any effect on migration or extinction of wildlife.
- There is no National Park, Biosphere Reserve, Wildlife corridors, and Tiger/Elephant Reserve found within 10 km radius of the project site.

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

- The major lake along the project sites doesn't have a rich biodiversity and almost all the species of both fauna and flora listed are either least concerned or not evaluated.
- There is no impact on fish habitats and the food WEB/ food chain in the water body and Reservoir.

Table No. 4.3. Overall Ecological impact assessments of Nalmukkal Village, Rough stone Quarry, Marakkanam Taluk, Villupuram District and Tamil Nadu.

S.No	Attributes	Assessment
	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	Nil
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)

TABLE 4.12: RECOMMENDED SPECIES FOR GREENBELT DEVELOPMENT PLAN

SL.No	Name of the plant (Botanical)	Family Name	Common Name	Habit
1	<i>Azadirachta indica</i>	Meliaceae	Neem, Vembu	Tree
2	<i>Albiziafalcatoria</i>	Fabaceae	Tamarind, Puliyamaram	Tree
3	<i>Polyalthialongifolia</i>	Annonaceae	Kattumaram	Tree
4	<i>Borassus Flabellifer</i>	Arecaceae	Palmyra Palm	Tree

The 7.5m Safety distance along the boundary has been identified to be utilized for subsequent Afforestation. However, the afforestation should always be carried out in a systematic and scientific manner. Regional trees like Neem,

Pongamia, Pinnata will be planted along the Lease boundary and avenue plantation will be carried out in the project site. The rate of survival expected to be 80% in this area. Greenbelt development Plan is given in

TABLE 4.13: GREENBELT DEVELOPMENT PLAN

Year	No. of trees proposed to be planted	Area to be covered in m ²	Name of the species
I	900	The safety zone along the boundary barrier has been identified to be utilized for Greenbelt development and along village roads.	Neem, Pongam, Mahogany etc.,

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

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

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

4.7.2 Noise

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

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

4.7.3 Physical Hazards

The following measures are proposed for control of physical hazards

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

4.7.4 Occupational Health Survey

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

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

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

4.8 MINE WASTE MANAGEMENT

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

4.9 MINE CLOSURE

The ultimate depth of the mine is 32m bgl and the life of the mine is 10 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 1.26.20 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 discharge likely to cause adverse impacts is predicted in advance, appropriate mitigation measures like settling of suspended solids or passive treatment to improve water quality as well as quantity, etc., could be planned. Monitoring should demonstrate that there is no adverse effect of pollutant concentrations exceeding the statutory limits for the water, soil and air qualities in the area around the closed mine.

4.9.1.3 Biological Stability

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

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

- Where the nutrient level of spread topsoil is lower than material in-situ e.g., for development of social forestry
-

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

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

5. ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.0 DESCRIPTION OF EACH ALTERNATIVE

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 SUMMARY OF ADVERSE IMPACTS OF EACH ALTERNATIVE

The surrounding areas already undergone quarrying operation, there are 10 Crushers within the radius of 1km. Most of the quarries in the regions are abandoned and lease expired quarries. Hence this quarry will feed the Rough stone material to the crushing units.

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 MITIGATION MEASURES PROPOSED FOR EACH ALTERNATIVE

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 areas have following advantages –

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

5.4 SELECTION OF ALTERNATIVE

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

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.

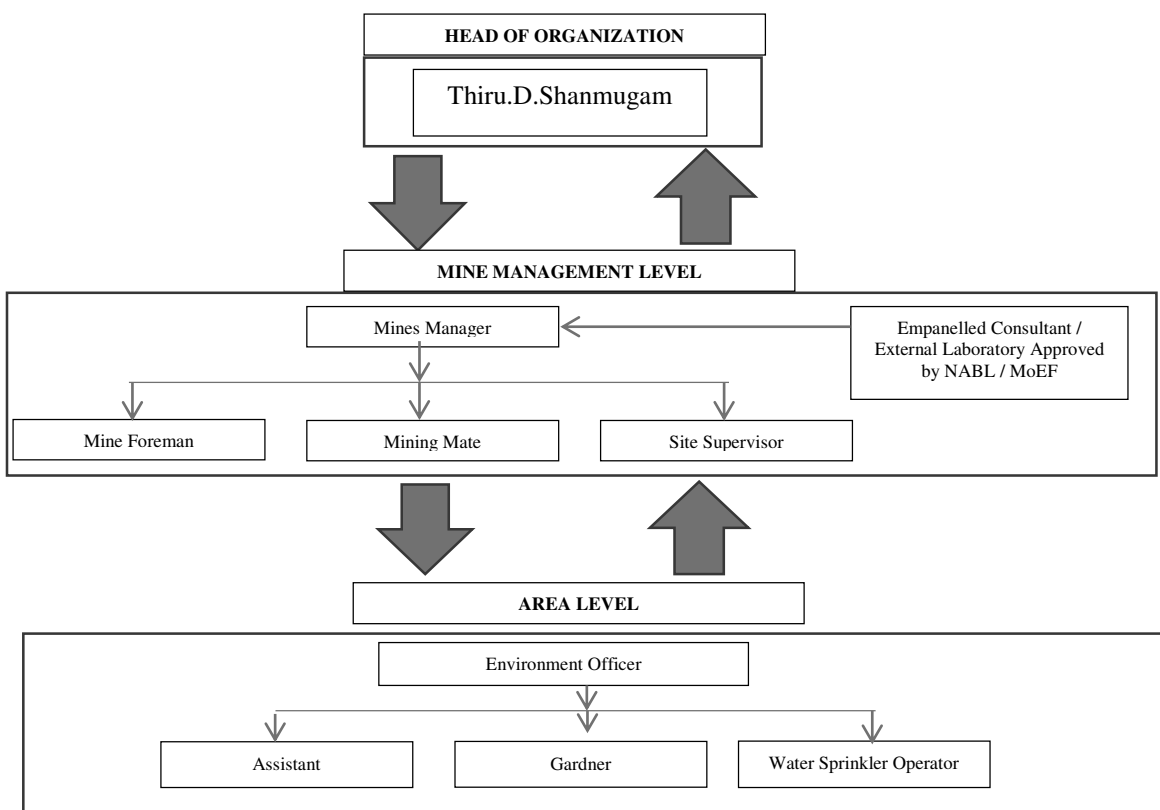
An Environment monitoring cell (EMC) will be constituted to monitor the implementation of EMP and other environmental protection measures in all the proposed quarries.

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 _{2.5} , PM ₁₀ , SO ₂ and NO _x .
2	Meteorology	At mine site before start of Air Quality Monitoring & IMD Secondary Data	Hourly / Daily	Continuous online monitoring	Wind speed, Wind direction, Temperature, Relative humidity and Rainfall
3	Water Quality Monitoring	2 Locations (1SW & 1 GW)	-	Once in 6 months	Parameters specified under IS:10500, 1993 & CPCB Norms
4	Hydrology	Water level in open wells in buffer zone around 1 km at specific wells	-	Once in 6 months	Depth in 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/- and the recurring cost is Rs 76,000 per annum for each Proposed Project.

TABLE 6.3 ENVIRONMENT MONITORING PROGRAM BUDGET

S.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	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

		Operator of truck leaving his cabin when it is loaded.	
6	Natural calamities	Unexpected happenings	Escape Routes will be provided to prevent inundation of storm water Fire Extinguishers & Sand Buckets
7	Failure of Mine Benches and Pit Slope	Slope geometry, Geological structure	Ultimate or over all pit slope shall be below 60° and each bench height shall be 5m height.

Source: Analysed and Proposed by FAE & EC

7.3 DISASTER MANAGEMENT PLAN

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

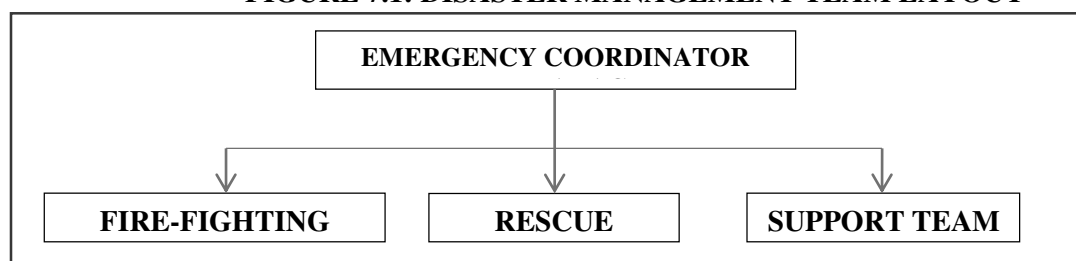
The Disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities.

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 SOCIAL IMPACT ASSESSMENT

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

PROPOSED QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
P1	Thiru.D.Shanmugam S/o. D. Durai, No. 11, Kulakkarai Street, Kilarungunam Village, Marakkanam Taluk, Viluppuram District – 604 301	Nalmukkal	27/4 & 27/5	1.76.5	File No.11637 TOR Identification No. TO24B0108TN5849832N Dated: 03.03.2025.
P2	Thiru.V.Nagarajan	Nalmukkal	34/1B1, 35/2B, 35/3, 35/4	4.75.0	Application in Process
	TOTAL EXTENT			6.51.5	
EXISTING QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
E-1	Thiru.V.Ravichandran	Nalmukkal	26/1B1,27/3A & 27/3B	1.35.0	29.12.2022 to 28.12.2027
E-2	D.Durai	Nalmukkal	27/6, 27/7, 27/8	1.20.0	06.12.2022 to 05.12.2027
	TOTAL EXTENT			2.55.0	
ABANDONED / EXPIRED QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
A-1	A.Sivananthan	Nalmukkal	28/3	1.64.0	-
A-2	V.Ravichandran	Nalmukkal	26/1A,26/1B1, 26/2A,27/3B,2 8/1B	3.17.5	-
A-3	V.Ravi	Nalmukkal	26/3	0.37.5	-
A-4	P.Gopi	Nalmukkal	26/4	0.98.0	-
	TOTAL EXTENT			6.17.0	
	TOTAL CLUSTER EXTENT			9.06.5 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 “P1”

Name of the Project	Thiru.D.Shanmugam Rough Stone and Gravel Quarry	
S.F. No.	27/4 & 27/5	
Extent	1.76.5 ha	
Village,Taluk and District	Nalmukkal Village, Marakkanam Taluk, Viluppuram District.	
Land Type	It is a patta land registered in the name of applicant Thiru.D.Shanmugam vide patta No.924	
Toposheet No	57 P/16	
Latitude between	12° 13' 11.6217"N to 12° 13' 18.8071"N	
Longitude between	79° 45' 53.7466"E to 79° 46' 00.2482"E	
Elevation of the area	72m AMSL	
Lease period	10 Years	
Mining Plan period	10 years	
Proposed Depth of Mining	25m bgl	
Geological Resources	Rough Stone in m ³	Gravel m ³
	6,17,750	35,300
Mineable Reserves	151259	24648
Year wise Production for 1 st five years	77478	24648
Year wise Production for 2 nd five years	73781	-
Peak Production	21520	8826
Ultimate Pit Dimension	XY-AB-52m (L) x 87m (W) x 20m(D) bgl XY-CD-66m (L) x 52m (W) x 25m(D) bgl X1Y1-AB-39m (L) x 112m (W) x 15m(D) bgl	
Water Level in the region	50-55 m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and Controlled blasting using Slurry Explosives	
Topography	The lease applied area is flat terrain. The area has gentle sloping towards North eastern side and altitude of the area is 72m above from Mean Sea level. The area is covered by 2m thickness of Gravel and followed by Massive Charnockite which is clearly inferred from the surface outcrops & nearby existing quarry pit.	
Machinery proposed	Hand Jack Hammer	3 Nos
	Compressor	1 No
	Excavator with Bucket and Rock Breaker	1 No
	Tippers	2 Nos
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	21 Nos	
Project Cost	Rs. 58,33,000/-	
EMP Cost	Rs.7,60,000/-	
Total Project cost	Rs. 65,93,000/-	
CER Cost	Rs. 5,00,000/-	
Nearby Water Bodies	Nalmukkal Eri	250m South
	Odai	480m SW
	Kunnapakkam Lake	870m NE

	Budderi	880m NW
	Ariyanthangal Eri	1.3km SE
	Perumukkal Eri	2.3km SW
Greenbelt Development Plan	Proposed to plant 900 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	1.6 KLD	
Nearest Habitation	700m – South West	
Nearest Reserve Forest	Kilisevur R.F. – 3.70 km – North West (Source – DFO Letter)	
Nearest Wild Life Sanctuary	Oussudu Lake Birds Sanctuary -27.31km-South	

Source: Approved Mining Plan

TABLE 7.7: SALIENT FEATURES OF PROPOSAL “E1”

Name of the Project	Thiru.V.Ravichandran Rough Stone and Gravel Quarry		
S.F. No.	26/1B1, 27/3A & 27/3B		
Extent	1.35.0 ha		
Village,Taluk and District	Nalmukkal Village, Marakkanam Taluk, Viluppuram District.		
Land Type	It is a patta land registered in the name of applicant Thiru.V.Ravichandran vide patta No.447 &191		
Toposheet No	57 P/16		
Latitude between	12° 13' 15.37"N to 12° 13' 19.60"N		
Longitude between	79° 45' 57.76"E to 79° 46' 04.24"E		
Elevation of the area	59m AMSL		
Lease period	5 Years		
Mining Plan period	5 years		
Proposed Depth of Mining	29m bgl		
Geological Resources	Rough Stone in m ³	Gravel m ³	Top Soil m ³
	316800	25344	25344
Mineable Reserves	107475	6328	6328
Year wise Production for five years	107475	6328	6328
Ultimate Pit Dimension	Pit I -174m (L) x 55m (W) x 29m(D) bgl		
Water Level in the region	52-56 m bgl		
Method of Mining	Opencast Mechanized Mining Method involving drilling and Controlled blasting using Slurry Explosives		
Topography	The lease applied area is flat terrain. The area has gentle sloping towards North eastern side and altitude of the area is 59m above from Mean Sea level. The area is covered by 2m thickness of Gravel and followed by Massive Charnockite which is clearly inferred from the surface outcrops & nearby existing quarry pit.		
Machinery proposed	Hand Jack Hammer	6Nos	
	Compressor	2 No	
	Excavator with Bucket and Rock Breaker	1 No	
	Tippers	2 Nos	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.		

Proposed Manpower Deployment	29 Nos
Project Cost	Rs. 23,63,000/-
EMP Cost	Rs.3,80,000/-
Total Project cost	Rs. 27,43,000/-
CER Cost	Rs. 5,00,000/-
Greenbelt Development Plan	Proposed to plant 270 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	1.5 KLD
Nearest Habitation	880m – South West

Source: Approved Mining Plan

TABLE 7.8: SALIENT FEATURES OF PROPOSAL “E2”

Name of the Project	Thiru.D.Durai Rough Stone and Gravel Quarry	
S.F. No.	27/6, 27/7 & 27/8	
Extent	1.20.0 ha	
Village, Taluk and District	Nalmukkal Village, Marakkanam Taluk, Viluppuram District.	
Land Type	It is a patta land registered in the name of applicant Thiru.D.Durai vide patta No.329	
Toposheet No	57 P/16	
Latitude between	12° 13' 07.13"N to 12° 13' 15.11"N	
Longitude between	79° 45' 55.17"E to 79° 45' 59.70"E	
Elevation of the area	72m AMSL	
Lease period	5 Years	
Mining Plan period	5 years	
Proposed Depth of Mining	37m bgl	
Geological Resources	Rough Stone in m ³	Gravel m ³
	647500	37000
Mineable Reserves	187420	24616
Year wise Production for five years	187420	24616
Ultimate Pit Dimension	Pit I -190m (L) x 83m (W) x 37m(D) bgl	
Water Level in the region	52-56 m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and Controlled blasting using Slurry Explosives	
Topography	The lease applied area is flat terrain. The area has gentle sloping towards North eastern side and altitude of the area is 59m above from Mean Sea level. The area is covered by 2m thickness of Gravel and followed by Massive Charnockite which is clearly inferred from the surface outcrops & nearby existing quarry pit.	
Machinery proposed	Jack Hammer	5 Nos
	Compressor	2 No
	Excavator with Bucket and Rock Breaker	1 No
	Tippers	2 Nos

Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.
Proposed Manpower Deployment	22 Nos
Project Cost	Rs. 36,41,000/-
EMP Cost	Rs.3,80,000/-
Total Project cost	Rs. 40,21,000/-
CER Cost	Rs. 5,00,000/-
Greenbelt Development Plan	Proposed to plant 250 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	1.6 KLD
Nearest Habitation	620m – South West

Source: Approved Mining Plan

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 7.16 & 7.17.

TABLE 7.11: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE

Quarry	Production for five-year plan period	Per Year Production in m ³	Per Day Production in m ³	Number of Lorry Load Per Day
P1	151259	15126	50	4
Total	151259	15126	50	4
E1	107475	21495	72	6
E2	187420	37484	125	10
Total	294895	58979	197	16
Grand Total	446154	74105	247	20

TABLE 7.12: CUMULATIVE PRODUCTION LOAD OF GRAVEL

Quarry	Production for five-year plan period	Per Year Production in m ³	Per Day Production in m ³	Number of Lorry Load Per Day
P1	24648	8216	27	2
Total	24648	8216	27	2
E1	6328	2109	7	1
E2	24616	8205	27	2
Total	30944	10314	34	3
Grand Total	55592	18530	61	5

On a cumulative basis considering the proposed quarries, it can be seen that the overall production of Rough Stone is 247m³ per day and overall production of Gravel is 61m³ per day with a capacity of 20 trips of Rough Stone per day and 5 Trips per day of Gravel from the cluster.

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

Based on the above production quantities the emissions due to various activities in all the 3 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 7.18.

TABLE 7.14: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS

EMISSION ESTIMATION FOR QUARRY “P1”				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM ₁₀	Drilling	Point Source	0.065172873	g/s
	Blasting	Point Source	0.000284413	g/s
	Mineral Loading	Point Source	0.039395492	g/s
	Haul Road	Line Source	0.002486869	g/s/m
	Overall Mine	Area Source	0.048595768	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.000309419	g/s
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000012418	g/s
EMISSION ESTIMATION FOR QUARRY “E1”				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM ₁₀	Drilling	Point Source	0.099790623	g/s
	Blasting	Point Source	0.002393664	g/s
	Mineral Loading	Point Source	0.043872754	g/s
	Haul Road	Line Source	0.002495978	g/s/m
	Overall Mine	Area Source	0.075420566	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.001041021	g/s
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000105974	g/s
EMISSION ESTIMATION FOR QUARRY “E2”				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM ₁₀	Drilling	Point Source	0.095256515	g/s
	Blasting	Point Source	0.001897090	g/s
	Mineral Loading	Point Source	0.043197958	g/s
	Haul Road	Line Source	0.002493994	g/s/m
	Overall Mine	Area Source	0.064824751	g/s
Estimated Emission Rate for SO ₂	Overall Mine	Area Source	0.000864373	g/s
Estimated Emission Rate for NO _x	Overall Mine	Area Source	0.000063352	g/s

Source: Emission Calculation

TABLE 7.15: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM₁₀ in µg/m³	
Background	45.6
Incremental	14.85
Resultant	75.3
NAAQ Norms	100 µg/m³
PM_{2.5} in µg/m³	
Background	21.4
Incremental	6.97
Resultant	28.37
NAAQ Norms	60 µg/m³
So₂ in µg/m³	
Background	6.7

Incremental	1.89
Resultant	8.59
NAAQ Norms	80 µg/ m³
No2 in µg/m³	
Background	23.5
Incremental	9.62
Resultant	33.52
NAAQ Norms	80 µg/ m³

Noise Environment –

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

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

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

Where:

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

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

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

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 7.16: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER

Location ID	Background Value (Day) dB(A)	Incremental Value dB(A)	Total Predicted dB(A)	Residential Area Standards dB(A)
Habitation Near P1	48.2	47.3	46.3	55
Habitation Near E1	36.5	48.1	48.4	
Habitation Near E2	35.4	47.4	47.7	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 48.1 – 47.3 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations near habitations are within permissible limits of Residential Area (buffer zone) as per The Noise Pollution (Regulation And Control) Rules, 2000 (The Principal Rules were published in the Gazette of India, vide S.O.123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), 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 the all the 4 mines is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and

damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements nearby the mining areas and may cause injury to persons or damage to the structures. Nearest Habitations from 4 mines respectively are as in below Table 7.21.

TABLE 7.17: NEAREST HABITATION FROM EACH MINE

Location ID	Distance & Direction
Habitation Near P1	700m- South West
Habitation Near E1	880m- South West
Habitation Near E2	620m- South West

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 7.18: GROUND VIBRATIONS AT 3 MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	20	700m- South West	0.154
E1	30	880m- South West	0.148
E2	54	620m- South West	0.414

Source: Blasting Calculations

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

Socio Economic Environment –

The 6 mines shall contribute towards CER and the community shall develop.

TABLE 7.19: SOCIO ECONOMIC BENEFITS FROM 3 MINES

Location ID	Project Cost	CER
P1	Rs. 65,93,000/-	Rs.5,00,000/-
E1	Rs. 27,43,000/-	Rs.55,000/-
E2	Rs. 40,21,000/-	Rs.81,000/-
Total	Rs.1,33,57,000/-	Rs.6,36,000/-

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

- Proposed Project shall fund towards CER – **Rs 5,00,000/-**

TABLE 7.20: EMPLOYMENT BENEFITS FROM 3 MINES

Description	Employment
P1	21
Total	21
E1	29
E2	22
Total	51
Grand Total	72

A total of 21 people will get employment due to 1 proposed mines in cluster and 51 people are already employed at existing mines.

TABLE 7.21: GREENBELT DEVELOPMENT BENEFITS FROM 3 MINES

CODE	No of Trees proposed to be planted	Area Covered Sq.m	Name of the Species
P1	900	The safety zone along the boundary barrier has been identified to be utilized for Greenbelt development	Neem, Pungam, Mahogany , Vilvam etc.,
Total	900		
E1	270		
E2	250		
Total	520		
G.Total	1420		

Based on the Proposed Mining Plans it's anticipated that there shall growth of native species of Neem, Pinnata et., in the Cluster at a rate of 1420 Trees Planted over a period of 5 Years with Survival Rate of 80% by proposed 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 7.22: 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 2 Proposed quarries and 2 existing quarries total extent of the cluster is 9.06.05 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

PROPOSED QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
P1	Thiru.D.Shanmugam S/o. D. Durai, No. 11, Kulakkarai Street, Kilarungunam Village, Marakkanam Taluk, Viluppuram District – 604 301	Nalmukkal	27/4 & 27/5	1.76.5	File No.11637 TOR Identification No. TO24B0108TN5849832N Dated: 03.03.2025.
P2	Thiru.V.Nagarajan	Nalmukkal	34/1B1, 35/2B, 35/3, 35/4	4.75.0	Application in Process
	TOTAL EXTENT			6.51.5	
EXISTING QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status

E-1	Thiru.V.Ravichandran	Nalmukkal	26/1B1,27/3A & 27/3B	1.35.0	29.12.2022 to 28.12.2027
E-2	D.Durai	Nalmukkal	27/6, 27/7, 27/8	1.20.0	06.12.2022 to 05.12.2027
TOTAL EXTENT				2.55.0	
ABANDONED / EXPIRED QUARRIES					
Code	Name of the Owner	Village	S.F. Nos	Extent in Ha	Status
A-1	A.Sivananthan	Nalmukkal	28/3	1.64.0	-
A-2	V.Ravichandran	Nalmukkal	26/1A,26/1B1, 26/2A,27/3B,28 /1B	3.17.5	-
A-3	V.Ravi	Nalmukkal	26/3	0.37.5	-
A-4	P.Gopi	Nalmukkal	26/4	0.98.0	-
TOTAL EXTENT				6.17.0	
TOTAL CLUSTER EXTENT				9.06.5 Ha	

STANDARD OPERATING PROCEDURE FOR NALMUKKAL 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.
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- 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 Nalmukkal Village aims to produce 1,51,259 m³ Rough Stone over a period of 5 Years and Gravel 24,648m³ for period of 3 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 21 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 quarries are located in Nalmukkal Village, Marakkanam Taluk and Viluppuram District of Tamil Nadu and the area have communications, roads and other facilities already well established. The following physical infrastructure facilities will further improve due to proposed mine.

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

8.4 IMPROVEMENT IN SOCIAL INFRASTRUCTURE

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

8.5 OTHER TANGIBLE BENEFITS

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

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

CORPORATE SOCIAL RESPONSIBILITY

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 Nalmukkal 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.

CORPORATE ENVIRONMENT RESPONSIBILITY

For the existing quarries 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 5,00,000/- 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 5,00,000/-

9. ENVIRONMENTAL COST BENEFIT ANALYSIS

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

10. ENVIRONMENTAL MANAGEMENT PLAN

10.0. GENERAL

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

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

10.1. ENVIRONMENTAL POLICY

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

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

Source: Proposed by FAE's & EIA Coordinator

10.3. SOIL MANAGEMENT

There overburden in the form of Gravel which will directly loaded into tippers for the filling and levelling of low-lying areas.

TABLE 10.2. PROPOSED CONTROLS FOR SOIL MANAGEMENT

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

Source: Proposed by FAE's & EIA Coordinator

10.4. WATER MANAGEMENT

In the proposed quarrying project, no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mines office. The quarrying operation is proposed upto a depth of 32 m BGL, the water table in the area is 56 m below ground level, hence the proposed project 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 are 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 – P1

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

TABLE 10.7: PROPOSED GREENBELT ACTIVITIES

Year	No. of trees proposed to be planted	Area to be covered	Name of the species
I	900	The plantation is along the safety distance, village road etc..	Neem, Pungam, Vilvam, Mahogany etc.,

Source: Approved Mining plan

The objectives of the greenbelt development plan are –

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

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

10.8.2. Species Recommended for Plantation

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

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

TABLE 10.8. RECOMMENDED SPECIES FOR THE PLANTSATION

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

Source: Proposed by FAE's & EIA Coordinator

10.9. OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

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

10.9.1. Medical Surveillance and Examinations –

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 10.9. 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 an 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 10.11 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

TABLE 10.10: 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/tippers/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

Noise Environment	Source of noise will be during operation of transportation vehicles, HEMM for this proper maintenance will be done at regular intervals.	Provision made in Operating Cost	0	0
	Oiling & greasing of Transport vehicles and HEMM at regular interval will be done	Provision made in Operating Cost	0	0
	Adequate silencers will be provided in all the diesel engines of vehicles.	Provision made in Operating Cost	0	0
	It will be ensured that all transportation vehicles carry a fitness certificate.	Provision made in Operating Cost	0	0
	Safety tools and implements that are required will be kept adequately near blasting site at the time of charging.	Provision made in OHS part	0	0
	Line Drilling all along the boundary to reduce the PPV from blasting activity and implementing controlled blasting.	Provision made in Operating Cost	0	0
	Proper warning system before blasting will be adopted and clearance of the area before blasting will be ensured.	Blowing Whistle by Mining Mate / Blaster / Competent Person	0	0
	Provision for Portable blaster shed	Installation of Portable blasting shelter	50000	2000
	NONEL Blasting will be practiced to control Ground vibration and fly rocks	Rs. 30/- per 6 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 for garland drain @ Rs. 10,000/- per Hectare	5000	1000
	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 plan period	Provision made in Operating Cost	0	0
Implementation of EC, Mining Plan & DGMS Condition	Size 6' X 5' with blue background and white letters as mentioned in MoM Appendix II by the SEAC TN	Fixed Display Board at the Quarry Entrance as permanent structure mentioning Environmental Conditions	10000	1000
	Air, Water, Noise and Soil Quality Sampling every 6 Months for Compliance Report of EC Conditions	Submission of 2 Half Yearly Compliance - Lab Monitoring Report as per CPCB norms	0	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 on the south side of the hill 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 &CC OM 22-65/2017-IA.III Dated 25.02.2021	Lumpsum fund allocation	300000	0
TOTAL			565,000	303,000

In order to implement the environmental protection measures, an amount of Rs.5.65 lakhs as capital cost and recurring cost as Rs. 3.03 lakhs as recurring cost is proposed considering present market price considering present market scenario for the proposed project.

10.10.: CONCLUSION –

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

11. SUMMARY AND CONCLUSION

This EIA & EMP report prepared for the proposed Rough Stone and Gravel Quarry project located in S.F. Nos 27/4 & 27/5, Nalmukkal Village, Marakkanam Taluk and Viluppuram District belongs to Thiru.D.Shanmugam the Project falls in the Cluster category consist of 2 Proposed, 2 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 December 2024 – February 2025 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 21 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.D.Shanmugam Rough Stone and Gravel Quarry (Extent – 1.76.5 ha).

12. DISCLOSURE OF CONSULTANT

Thiru.D. Shanmugam have engaged with 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 for the proposed project.

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	A	WP GEO SC	B A A
2	Dr. P. Thangaraju	In-house	-	-	HG GEO	A A
3	Mr. A. Jagannathan	In-house	-	-	AP NV SHW	B A B
4	Mr. N. Senthilkumar	Empanelled	38 28	B B	AQ WP RH	B B A
5	Mrs. Jisha parameswaran	In-house	-	-	SW	B
6	Mr. Govindasamy	In-house	-	-	WP	B
7	Mrs. K. Anitha	In-house	-	-	SE	A
8	Mrs. Amirtham	In-house	-	-	EB	B
9	Mr. Alagappa Moses	Empanelled	-	-	EB	A
10	Mr. A. Allimuthu	In-house	-	-	LU	B
11	Mr. S. Pavel	Empanelled	-	-	RH	B
12	Mr. J. R. Vikram Krishna	Empanelled	-	-	SHW RH	A A

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

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/EMP

This EIA/EMP for Thiru.D.Shanmugam Rough Stone & Gravel Quarry over an Extent of 1.76.5 ha in Nalmukkal Village of Marakkanam Taluk, Viluppuram District of Tamil Nadu. It is also certified that information furnished in the above EIA study are true and correct to the best of our knowledge.

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

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

Designation: **EIA Coordinator**

Date & Signature:

Dr. M. Ifthikhar Ahmed

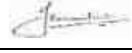
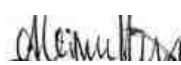
Period of Involvement: **March 2024 to till date**

Associated Team Member with EIA Coordinator:

1. **Mr. S. Nagamani**
2. **Mr. Viswathanan**
3. **Mr. Santhoshkumar**
4. **Mr. S. Ilavarasan**

FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

Sl. No.	Functional Area	Involvement	Name of the Expert/s	Signature
1	AP	- Identification of different sources of air pollution due to the proposed mine activity - Prediction of air pollution and propose mitigation measures / control measures	Mr. A. Jagannathan	<i>[Signature]</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>
			Mr. N. Senthilkumar	<i>[Signature]</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>[Signature]</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. M. Ifthikhar Ahmed	<i>Dr. M. Ifthikhar Ahmed</i>
			Dr. P. Thangaraju	<i>[Signature]</i>
5	SE	- Revision in secondary data as per Census of India, 2011. - Impact Assessment & Preventive Management Plan - Corporate Environment Responsibility.	Mrs. K. Anitha	<i>[Signature]</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.	Mrs. Amirtham	<i>[Signature]</i>
			Mr. Alagappa Moses	<i>[Signature]</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. N. Senthilkumar	
			Mr. S. Pavel	
			Mr. J. R. Vikram Krishna	
8	LU	- Construction of Land use Map - Impact of project on surrounding land use - Suggesting post closure sustainable land use and mitigative measures.	Mr. A. Allimuthu	
9	NV	- Identify impacts due to noise and vibrations - Suggesting appropriate mitigation measures for EMP.	Mr. A. Jagannathan	
10	AQ	- Identifying different source of emissions and propose predictions of incremental GLC using AERMOD. - Recommending mitigations measures for EMP	Mr. N. Senthilkumar	
11	SC	Assessing the impact on soil environment and proposed mitigation measures for soil conservation	Dr. M. Ifthikhar Ahmed	
12	SHW	- Identify source of generation of non-hazardous solid waste and hazardous waste. - Suggesting measures for minimization of generation of waste and how it can be reused or recycled.	Mr. A. Jagannathan	
			Mr. J. R. Vikram Krishna	

LIST OF TEAM MEMBERS ENGAGED IN THIS PROJECT

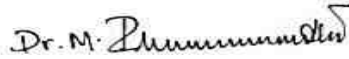
Sl.No.	Name	Functional Area	Involvement	Signature
1	Mr. S. Nagamani	AP; GEO; AQ	- Site Visit with FAE - Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures - Provide inputs on Geological Aspects - Analyse & provide inputs and assist FAE with meteorological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

			- Assist FAE with collection of data's - Provide inputs by analysing primary and secondary data	
6	Mr. S. Ilavarasan	LU; SC	- Site Visit with FAE - Assisting FAE in preparation of land use maps - Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
7	Mr. E. Vadivel	HG	- Site Visit with FAE - Assist FAE & provide inputs on aquifer characteristics, ground water level/table - Assist with methods of ground water recharge and conduct pump test, flow rate	
8	Mr. D. Dinesh	NV	- Site Visit with FAE - Assist FAE and provide inputs on impacts due to proposed mine activity and suggest mitigation measures - Assist FAE with prediction modelling	
9	Mr. Panneer Selvam	EB	- Site Visit with FAE - Assist FAE with collection of baseline data - Provide inputs and assist with labelling of Flora and Fauna	
10	Mrs. Nathiya	EB	- Site Visit with FAE - Assist FAE with collection of baseline data - Provide inputs and assist with labelling of Flora and Fauna	

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Ifthikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above-mentioned Functional Area Experts and Team Members prepared the EIA/EMP for Thiru .D.Shanmugam Rough Stone & Gravel Quarry over an Extent of 1.76.5 ha in Nalmukkal Village of Marakkanam Taluk, Viluppuram District of Tamil Nadu. It is also certified that information furnished in the EIA study are true and correct to the best of our knowledge.

Signature& Date:



Name:

Dr. M. Ifthikhar Ahmed

Designation:

Managing Partner

Name of the EIA Consultant Organization:

M/s. Geo Exploration and Mining Solutions

NABET Certificate No & Issue Date:

NABET/EIA/2225/RA 0276 Dated: 20-2-2023

Validity:

Valid till 06.08.2025